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UTAH DIVISION OF  
SOLID & HAZARDOUS WASTE



**San Juan County Landfill  
San Juan County, Utah**

# **APPLICATION FOR RENEWAL SOLID WASTE LANDFILL PERMIT 93-05**

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## **CLASS I MUNICIPAL SOLID WASTE LANDFILL**

**PREPARED BY:**



5250 Neil Road, Suite 300  
Reno, Nevada 89502  
(775) 828-6800  
(775) 828-6820 (Fax)  
Web Address: [www.srk.com](http://www.srk.com)  
e-mail: [reno@srk.com](mailto:reno@srk.com)

May 2005  
SRK Project No. 106802

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## **PART I - GENERAL DATA**

# Utah Class I and V Landfill Permit Application Form

<b>Part I General Information</b> APPLICANT: PLEASE COMPLETE ALL SECTIONS.					
<b>I. Landfill Type</b>		<b>II. Application Type</b>		<b>Facility Expansion Modification</b>	
<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class V		<input type="checkbox"/> New Application <input checked="" type="checkbox"/> Renewal Application		<input type="checkbox"/> Facility Expansion <input type="checkbox"/> Modification	
For Renewal Applications, Facility Expansion Applications and Modifications Enter Current Permit Number <b>93-05R</b>					
<b>III. Facility Name and Location</b>					
Legal Name of Facility San Juan County Landfill					
Site Address (street or directions to site) 11 miles south of Blanding, UT on State Route 262				County San Juan	
City Blanding		State UT	Zip Code 84511	Telephone 435-678-3070	
Township T39S	Range R22E	Section(s) 3, 4, 9, 10	Quarter/Quarter Section	Quarter Section	
Main Gate Latitude	degrees 37	minutes 25	seconds 03	Longitude	degrees 109 minutes 29 seconds 23
<b>IV. Facility Owner(s) Information</b>					
Legal Name of Facility Owner San Juan County					
Address (mailing) 117 South Main Street					
City Monticello		State UT	Zip Code 84535	Telephone 435-587-3225	
<b>V. Facility Operator(s) Information</b>					
Legal Name of Facility Operator San Juan County					
Address (mailing) 117 South Main Street					
City Monticello		State UT	Zip Code 84535	Telephone 435-587-3225	
<b>VI. Property Owner(s) Information</b>					
Legal Name of Property Owner San Juan County					
Address (mailing) 117 South Main Street					
City Monticello		State UT	Zip Code 84535	Telephone 435-587-3225	
<b>VII. Contact Information</b>					
Owner Contact Rick Bailey			Title County Administrator		
Address (mailing) 117 South Main Street					
City Monticello		State UT	Zip Code 84535	Telephone 435-587-3225	
Email Address rmbailey@sanjuancounty.org			Alternative Telephone (cell or other)		435-459-1807
Operator Contact Harold Keylon			Title Landfill Operations Manager		
Address (mailing) Post Office Box 5					
City Blanding		State UT	Zip Code 84511	Telephone 435-678-3070	
Email Address rmbailey@sanjuancounty.org			Alternative Telephone (cell or other)		435-587-3225
Property Owner Contact Rick Bailey			Title County Administrator		
Address (mailing) 117 South Main Street					
City Monticello		State UT	Zip Code 84535	Telephone 435-587-3225	
Email Address rmbailey@sanjuancounty.org			Alternative Telephone (cell or other)		435-459-1807

# Utah Class I and V Landfill Permit Application Form

Part I General Information (Continued)			
<b>VIII. Waste Types</b> (check all that apply)			<b>IX. Facility Area</b>
Waste Type	Combined Disposal Unit	Monofill Unit	Facility Area..... 390 acres
<input type="checkbox"/> Municipal Waste	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Disposal Area..... 27.3 acres
<input type="checkbox"/> Construction & Demolition	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Design Capacity
<input type="checkbox"/> Industrial	<input type="checkbox"/>	<input type="checkbox"/>	Years..... 51 (remaining)
<input type="checkbox"/> Incinerator Ash	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cubic Yards..... 1,946,800 (remaining)
<input type="checkbox"/> Animals	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Tons..... 744,000 (waste)
<input type="checkbox"/> Asbestos	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<input type="checkbox"/> PCB's (R315-315-7(3) only)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/> Other	<input type="checkbox"/>	<input type="checkbox"/>	
<b>X. Fee and Application Documents</b>			
Indicate Documents Attached To This Application		<input checked="" type="checkbox"/> Application Fee: Amount \$ 100.00	Class V Special Requirements
<input checked="" type="checkbox"/> Facility Map or Maps	<input checked="" type="checkbox"/> Facility Legal Description	<input checked="" type="checkbox"/> Plan of Operation	<input type="checkbox"/> Documents required by UCA 19-6-108(9) and (10)
<input checked="" type="checkbox"/> Ground Water Report	<input checked="" type="checkbox"/> Closure Design	<input checked="" type="checkbox"/> Cost Estimates	<input checked="" type="checkbox"/> Financial Assurance
<b>I HEREBY CERTIFY THAT THIS INFORMATION AND ALL ATTACHED PAGES ARE CORRECT AND COMPLETE.</b>			
Signature of Authorized Owner Representative		Title	Date
<i>Rick M. Bailey</i>		County Administrator	03/01/2005
Name typed or printed		Address	
Rick M. Bailey		117 So. Main St., Monticello, UT 84535	
Signature of Authorized Land Owner Representative (if applicable)		Title	Date
		Address	
Name typed or printed			
Signature of Authorized Operator Representative (if applicable)		Title	Date
		Address	
Name typed or printed			

## PART II - GENERAL REPORT

### 1.0 INTRODUCTION

This document constitutes an application for a) renewal of existing Solid Waste Landfill Permit 93-05R for Class I municipal solid waste disposal and existing Class IVb construction/demolition waste disposal cell, at the San Juan County Landfill. The San Juan County Landfill is designated as a Class I landfill based on an incoming municipal waste stream of more than 20 tons per day (based on an annual average) and the fact that the landfill is a county-owned facility operated on a not-for-profit basis. All proceeds generated by landfill operations are maintained in an enterprise fund for use in solid waste management and recycling programs throughout the county.

This application has been prepared in accordance with R315-310-4 and R315-310-5 of the Utah Administrative Code (UAC), and consists of a Plan of Operation, Geohydrological Assessment, Engineering Report, Closure Plan, Post-Closure Care Plan, and Financial Assurance documentation. The information presented in this application satisfies the requirements for both Class I and Class IVb permit applications, and is separated into three parts in accordance with the Utah Department of Environmental Quality's (UDEQ) recommended application format. Part I presents general facility information, such as site location and property ownership, and includes a certification of submitted information. Part II comprises the general report and presents a detailed description of the facility, site ownership, and zoning information, and presents the Plan of Operation for the facility. This part also presents relevant information regarding the operation of the facility's Class IV disposal cell, enabling UDEQ to permit the Class IV waste disposal cell separately from the municipal disposal cell. Part III is the technical report and presents general vicinity and site design maps, a geohydrological assessment of the site, the Engineering Report, the Closure Plan, the Post-Closure Care Plan, and Financial Assurance documentation. For ease of reference during document review, a reduced-size design drawing set has been included in Appendix A; the full size design drawing set is included at the end of the application in Appendix M.

The facility was first permitted by the Utah Department of Environmental Quality (UDEQ) on February 15, 1994 under Class I Solid Waste Landfill Permit 93-05. The permit was subsequently modified on May 2, 1995 to change the name of the facility and broaden the service area. A copy of the original permit and subsequent modifications and related correspondence are included in Appendix B. In December 1997, San Juan County submitted the *Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill, San Juan County, Utah* (Vector, 1997) to UDEQ for consideration. A subsequent addendum to the original request was submitted in April 1998 in response to a Request for Additional Information from UDEQ (dated February 26, 1998). Final approval of the regulatory suspension is documented in UDEQ's letter dated June 22, 1998, and signifies approval for continued operation of the San Juan County Landfill without the installation of a ground water monitoring or composite liner system. The suspension request and subsequent correspondence are included with this application in Appendix C. These documents are considered integral components of this application, providing

the majority of the information required of a Geohydrological Assessment (UAC R315-310-4(2)(b)).

The *Application for Renewal, Solid Waste Landfill Permit 93-05* was submitted in June 1999. UDEQ completed the technical review and requested additional information in a letter dated December 9, 1999. San Juan County issued its response to UDEQ's comments in a letter from SRK Consulting dated January 18, 2000. Permit 93-05R was subsequently issued on August 1, 2000. Copies of Permit 93-05, 93-05R and related correspondence are included in Appendix D.

In granting approval of the suspension request and the subsequent permit renewal application, UDEQ concurred with the County's assertion that the continued operation of the landfill without a ground water monitoring or composite liner system does not pose a threat to human health and safety or the environment. UDEQ's approval of the suspension request is considered to supersede earlier permit requirements for bottom liner and leachate collection systems. Therefore, this permit renewal application is submitted without provisions for ground water monitoring, composite liner construction, or a leachate collection system.

The existing San Juan County Landfill includes a Class I municipal solid waste disposal cell, a Class IVb construction/demolition waste disposal cell, and a dead animal disposal pit. A small transfer station is provided outside the facility gates for after-hours disposal of municipal solid waste. Additional on-site facilities include an emergency municipal disposal cell, a gatehouse and weigh scales, a maintenance shop, a storage shed, a pit toilet, perimeter fencing, storage tanks for waste automotive and cooking oil, and a water supply well. Existing site facilities are illustrated on Drawing 3, Appendices A and M.

### **1.1 Types of Waste Received**

The San Juan County Landfill accepted an average of approximately 34 tons of waste per day between 2001 and 2004, based on annual averages, is operated on a not-for-profit basis, and is therefore considered a Class I facility as defined by the Utah Solid Waste Permitting and Management Rules (UAC R513-301-2). The construction/demolition waste disposal cell has received only inert waste since the first receipt of waste in January 1996 and is therefore classified as an existing Class IVb disposal facility according to UAC R315-305-3(2,3). The San Juan County Landfill accepts the following types of waste for disposal or recycling:

- household waste (excluding bulk liquids);
- non-hazardous industrial waste;
- commercial waste;
- dead animals;
- white goods and scrap metal;
- tires;
- yard wastes;
- household hazardous wastes;
- red-bagged medical waste;

- non-friable asbestos waste;
- waste automotive and cooking oil; and
- construction/demolition waste.

The following types of waste are prohibited from disposal at the San Juan County Landfill:

- liquid waste;
- hazardous and polychlorinated bi-phenyl (PCB) wastes;
- medical waste from hospitals and clinics mixed with municipal waste;
- friable asbestos wastes; and
- hydrocarbon-contaminated soil.

The procedures for receipt, disposal, and/or handling of the various types of waste either accepted or prohibited are described in Section 2.3 of this report.

## **1.2 County Solid Waste Management Plan**

The San Juan County Landfill is the only Class I municipal solid waste disposal facility operating in San Juan County. The facility serves all of San Juan County and portions of Grand County to the north and the Navajo Nation to the south. The operation of the San Juan County Landfill is an integral component of the implementation of the San Juan County Solid Waste Management Plan, which in 1993 recommended the construction and use of a regional facility to serve San Juan County (Beehive Engineering, 1993).

## **1.3 Property Description and Ownership**

The San Juan County Landfill is located approximately 11 miles south of the City of Blanding in San Juan County, Utah, just southwest of the intersection of U.S. Route 191 and State Route 262. The latitude and longitude of the facility's entrance gate are approximately 37°25'30" and 109°28'30", respectively. As described by the Public Land Survey system and illustrated on Drawing 1 (Appendices A and M), the landfill occupies the following portions of Township 39 South, Range 22 East, Salt Lake Baseline and Meridian:

- SW $\frac{1}{4}$  SW $\frac{1}{4}$  and S $\frac{1}{2}$  SE $\frac{1}{4}$  SW $\frac{1}{4}$ , section 3;
- S $\frac{1}{2}$  SE $\frac{1}{4}$ , section 4;
- NE $\frac{1}{4}$ , section 9; and
- W $\frac{1}{2}$  NE $\frac{1}{4}$ , W $\frac{1}{2}$  NE $\frac{1}{4}$  NW $\frac{1}{4}$ , NW $\frac{1}{4}$  SW $\frac{1}{4}$  NW $\frac{1}{4}$ , section 10.

The landfill property was acquired from the United States Bureau of Land Management (BLM) through the Recreation and Public Purposes Act on July 3, 1995. San Juan County also holds a right-of-way grant for the landfill access road. Copies of the land patent document and the right-of-way grant are included with this document in Appendix E.

The land use designation of the landfill property was modified by action of the San Juan County Commission on September 12, 1994 from A-10 to CDI, or Controlled District Industrial, to accommodate the use of the County's property for solid waste disposal. A copy of the meeting minutes is included in Appendix F.

The land immediately adjacent to the landfill property on all sides is publicly owned and administered by BLM. The Melvin Adams Livestock Company owns 146 acres east of the landfill property, the western boundary of which lies 660 feet east of the landfill's eastern-most boundary. All land in the vicinity of the landfill property is zoned MU-40 for multiple uses including recreation, agriculture, and grazing. Maps obtained from the San Juan County Recorder's Office (included in Appendix F) illustrate the property ownership of the surrounding land. Site location and vicinity maps are included in Appendices A and M.

## **2.0 PLAN OF OPERATION**

This Plan of Operation has been prepared by San Juan County to reflect the operation of the San Juan County Landfill in compliance with the Utah Solid Waste Permitting and Management Rules, R315-301 through 320 of the UAC. This Plan of Operation is an integral part of this application for a permit renewal to operate a Class I facility as set forth in UAC R315-310-4, and is submitted to UDEQ as the solid waste management authority for San Juan County.

The San Juan County Landfill is owned and operated by San Juan County. County offices are located at 117 South Main Street in Monticello, Utah. The original Plan of Operation shall be retained at the County offices; a copy of the Plan will be maintained at the landfill gatehouse. All components of the landfill's operating record will be provided to UDEQ upon request for review. Responsibility for compliance with the Plan shall be that of the Landfill Manager. The plan will be available for review by employees involved in the daily operations of the facility, as well as to other parties and regulatory agencies, as requested. Landfill "attendant," as used in this document, refers to the landfill manager or his authorized representative.

If permitted operational procedures require modification, San Juan County will review applicable solid waste regulations to ensure that new or modified procedures satisfy regulatory criteria. San Juan County will provide UDEQ with a description of major revisions to approved waste management practices for review and approval prior to implementation at the landfill. Major revisions may include an expansion of disposal services or redefinition of the facility's service area or population. Approved modifications will be incorporated into the Plan of Operation and operating record for the facility.

### **2.1 Hours of Operation**

The San Juan County Landfill is open Monday through Friday from 9:00 am to 5:00 pm. A landfill attendant is on site at all times during operating hours. The landfill is closed on all major holidays.

### **2.2 Schedule of Construction**

The existing site layout and facilities are depicted on Drawings 3 and 4, while the site development plan is presented on Drawing 6. Design drawings are included with this document in Appendices A and M. The current plan for site development calls for continuous expansion of the existing municipal disposal cell in a counterclockwise direction around the knob abutting the northeast property boundary (Drawing 6). The cut and fill method will be used to expand the excavation in this direction while providing a continuous supply of daily cover material. Municipal waste

disposal will continue in lifts approximately 15 feet thick within the active area. Cell excavation and expansion is an ongoing process with no specific start or stop date.

Municipal waste disposal has occurred since the last permit renewal (August 2000) within Cell 1 (Drawing 6). During this time, waste disposal extended approximately 10 to 15 feet higher than depicted in the 1999 design drawings. Because the extra height does not have a significant effect on the original design concept, and can be accommodated without affecting either the stability or drainage characteristics of the original design, the new design drawings reflect an average vertical increase of the top deck elevation of approximately 15 feet.

A ridge of stockpiled soil previously separated the municipal disposal cell from the construction/demolition (C&D) waste disposal cell (Drawings 3 and 4). Expansion plans for the municipal waste disposal cell called for the removal of the separating ridge down to original ground surface and the expansion of the northern edge of the municipal cell to within 15 feet of the top edge (at original ground surface) of the C&D disposal cell. The ridge has been removed and disposal operations are currently occurring as planned between the C&D cell and the expanded northern edge of the municipal waste cell. This previously-approved expansion of the municipal cell maximizes available disposal capacity between the municipal and C&D disposal cells. Based on the relatively small volume of waste disposed of in the C&D disposal trench to date, it is anticipated that the existing cell will provide disposal capacity for some time. However, future disposal plans call for siting the next C&D disposal cell northwest of the current cell, as depicted on Drawing 5.

Loading rate calculations, discussed in detail in Section 4.3, indicate that the proposed final design of the site will provide disposal capacity for approximately 51 years. Minor modifications to the sequence of site development illustrated on Drawing 6 may be made to increase operational efficiency. Major modifications to the proposed disposal method will be submitted for review and approval by UDEQ prior to implementation.

## **2.3 Waste Handling Procedures**

All incoming vehicles are stopped by the landfill attendant at the gate. Commercial vehicles are weighed before and after discharging waste loads. Private haul vehicle load weights are estimated based on type and volume of waste. The date, time, vehicle owner, vehicle license number, actual or estimated weight of waste, type of waste, and origin of the waste are recorded on the "Daily Entry Report" form for every incoming load; a copy of the form is included in Appendix G. A receipt is issued for every incoming load. Daily totals are recorded on the "Daily Refuse Log Report" (Appendix G).

Each commercial and private load is inspected at the active disposal face for the presence of prohibited wastes. An "Inspection Log" form (Appendix G) is completed for all refused loads, and for accepted loads on a random basis. Inspection records are maintained in the landfill office. Inspection procedures are further discussed in Sections 2.3.12 and 2.3.13.



Landfill signs are positioned to direct incoming traffic to the appropriate disposal area. Private haulers are directed to discharge their loads in a public discharge area near the base or top of the active face, depending on the configuration of the access road to the disposal area. Commercial haulers dump directly at the active disposal face.

The following equipment is dedicated to the landfill for waste and soil handling and general site operations:

- 1995 Chevrolet pickup;
- 1989 Dodge Ram pickup;
- 2004 Dodge Dakota pickup;
- 1995 Caterpillar 816B landfill compactor;
- Caterpillar 623F paddle-wheel scraper;
- Caterpillar 140G grader;
- Caterpillar D-6N track dozer;
- Case Super L backhoe;
- 2001 Peterbuilt tilt-frame truck;
- 3,000-gallon skid-mounted water tank; and,
- Two diesel-powered generators.

Additional heavy equipment is available from San Juan County on an as-needed basis. Minor vehicle maintenance is performed on-site by landfill personnel. Major repairs are performed either at the County Road Department facilities or by a contractor.

### 2.3.1 Household and Commercial Wastes

Household waste is defined as any solid waste (excluding bulk liquids), including trash, garbage, and septic waste which passes the paint filter test (EPA Method 9095) derived from single or multiple-family dwellings, hotels, motels, bunkhouses, ranger stations, campgrounds, picnic grounds, and public recreation areas. Commercial wastes include solid waste generated by stores, offices, restaurants, warehouses, and other non-manufacturing activities, but exclude residential and industrial wastes.

Residential collection is mandatory in the incorporated cities of San Juan County. Private contractors provide residential collection services in these areas. The County maintains several transfer stations in outlying rural areas and provides for regular waste pickup and disposal at the landfill. Most of the waste generated in the County is municipal solid waste. Incoming waste from commercial and private haulers is discharged at or near the active disposal face. Landfill personnel move discharged loads from the unloading area to the active face. The waste is spread in layers not exceeding two feet in thickness, and compacted using multiple passes of a Caterpillar 816B steel-wheeled landfill compactor.

Incoming waste from residential haulers is directed to a small transfer station near the entrance facilities. The transfer station is located in a separate fenced area adjacent to the facility gates to accommodate daily and after hours disposal of municipal waste. The residential transfer station

consists of an access ramp, a concrete retaining wall, and a 20-cubic-yard disposal bin. Once the transfer station bin is full, the bin is weighed and the contents are dumped at the active disposal face. The location of the transfer facility is illustrated on Drawing 3.

### **2.3.2 Industrial Wastes**

The San Juan County Landfill does not currently accept industrial waste. However, the facility will accept non-hazardous solid waste generated by industrial sources, provided sufficient documentation is submitted to verify the non-hazardous nature of the material.

### **2.3.3 Dead Animals**

The San Juan County accepts dead animals for disposal in a separate monofill within the landfill property. All received dead animals are covered at the end of the working day with a minimum of six inches of soil.

### **2.3.4 White Goods and Scrap Metal**

White goods and scrap metal are stockpiled in a designated area. A licensed metal recycling service is contracted to remove at least half of the stockpile approximately once per year.

### **2.3.5 Tires**

Tires are currently stockpiled in a designated area until a sufficient amount is accumulated. At that time, the State of Utah is contacted and arrangements are made for tire pickup through the state-funded tire recycling program. Tire storage and stockpiling procedures will be conducted at all times in accordance with UAC R315-314-3. Tire piles will be maintained at least 40 feet from the property boundary and 50 feet from site buildings. Although it is anticipated that only a small amount of waste tires will be stockpiled at any given time, tire piles will be maintained at less than 10 feet high and will comprise less than 50,000 cubic feet. Fire lanes will be provided between tire piles and will be no less than 40 feet wide. If necessary, San Juan County will institute a vector control program to prevent breeding of mosquitoes and other insects within waste tires. San Juan County will obtain approval from the local fire department, if required, and will stockpile cover soil near the tire pile to provide for on-site fire abatement. Because the tire storage area will be an integral component of the landfill operation, financial assurance already provided for the landfill will be sufficient to provide for final tire pile closure.

### **2.3.6 Yard Wastes**

Yard waste is vegetative matter generated from landscaping, lawn maintenance, and land clearing operations and may include tree and brush trimmings, grass clippings, and other discarded material from yards, gardens, and parks. Yard waste does not include garbage, paper, plastic, sludge, septage, or manure. Loads containing only stumps, branches, tree clippings, and/or grass clippings are directed to a designated yard waste stockpile. The stockpile is periodically burned after the appropriate permits are obtained from the State of Utah.

### 2.3.7 Household Hazardous Wastes

San Juan County does not have an established program for household hazardous waste collection or management. The majority of household hazardous wastes are managed as part of the municipal waste stream. Used automotive batteries are not accepted at the landfill; batteries which are discovered in waste loads are pulled from the waste stream and stockpiled on pallets in a secured area until transported to local retailers for recycling. Additional provisions for special waste disposal are not planned at this time.

### 2.3.8 Medical Waste

The San Juan County Landfill accepts properly packaged and containerized medical and infectious wastes. Medical waste from hospitals and clinics which is mixed with municipal waste is not accepted for disposal. Properly transported and packaged medical waste accepted for disposal is placed at the base of the active disposal face, away from the public disposal area, and immediately covered with 12 inches of earth or waste material which does not contain infectious waste. Medical waste containers are not compacted until they are covered as described above.

### 2.3.9 Asbestos Wastes

The landfill currently accepts only non-friable asbestos waste for disposal. Although not currently planned, friable asbestos wastes may be accepted if the conditions of UAC R315-315-2 are satisfied as follows:

- the asbestos waste is adequately wetted and properly containerized by double bagging and sealing in 6 mil or thicker plastic bags to prevent fiber release and
- asbestos waste containers are appropriately labeled with the name of the waste generator, the location where the waste was generated, and tagged with a warning label that conforms to the requirements of 40 CFR Part 61.149(2).

If properly transported and packaged asbestos waste which meets these criteria is received at the landfill, the operator will:

- verify the quantities of waste received, sign off on the waste shipment record, and send a copy of the waste shipment record to the generator within 30 days;
- require vehicles that have transported asbestos waste to be marked with warning signs as specified in 40 CFR Part 61.149(d)(1)(iii);
- inspect the load to verify that the asbestos waste is properly contained in leak-proof containers and properly labeled;
- place asbestos containers at the bottom of the active face with sufficient care to avoid breaking the containers;
- cover the waste within 18 hours with a minimum of six inches of material that does not contain asbestos;
- provide barriers to limit public access to the asbestos disposal area until the waste has been covered with six inches of material which does not contain asbestos; and
- place warning signs at the entrance and around the perimeter of the asbestos disposal area which comply with 40 CFR 61.154(b).

The landfill attendant will inspect the incoming loads to verify that the asbestos waste is properly containerized in leak-proof containers and appropriately labeled. If the attendant believes the condition of an incoming asbestos load is such that significant amounts of fiber may be released during disposal, the attendant will notify the local and regional health departments and the Executive Secretary. If the wastes are not properly containerized, and the landfill operator inadvertently accepts the load, the operator shall thoroughly soak the asbestos material with a water spray prior to unloading, rinse out the haul truck, dispose of the waste near the base of the active face, and immediately cover the waste prior to compaction with six inches of non-asbestos material in a manner sufficient to prevent fiber release. A copy of applicable portions of 40 CFR 61 and UAC R315-315-2 are included in Appendix H.

### **2.3.10 Waste Automotive and Cooking Oil**

The San Juan County Landfill accepts waste automotive and cooking oil in waste oil storage tanks located near the landfill gatehouse. Waste automotive oil is collected in a tank located near the gatehouse and is periodically removed through the State of Utah's waste oil recycling program. The tank is situated within a large concrete enclosure with four-foot-high walls on all sides, and is thus provided with adequate secondary containment. Cooking oil and grease trap wastes are collected in a container located behind the gatehouse. Cooking oil and grease trap wastes are periodically removed by a commercial ranch for use in the production of livestock feed.

### **2.3.11 Construction/Demolition (C&D) Wastes**

UAC 315-301-2(16) defines construction/demolition (C&D) waste as waste from building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings, and other structures. Typical C&D waste includes bricks, concrete or other masonry materials, soil, rock, untreated lumber, rebar, and tree stumps. C&D waste does not include asbestos, asphalt, contaminated soils or tanks resulting from remediation or clean up at any release or spill, waste paints, solvents, sealers, adhesives, or similar hazardous or potentially hazardous materials. C&D waste is deposited in a separate monofill located north of the municipal disposal cell, as illustrated on Drawings 3 and 4. C&D waste is covered with soil as often as is necessary to reduce the potential for fires and vector harborage. The majority of the required components of a Class IVb facility permit application overlap with the requirements for permitting the Class I disposal cell at the San Juan County Landfill, and are thus provided throughout this document. Closure and post-closure costs presented in Appendix I include estimates to close and monitor the Class IVb disposal cell, in addition to the Class I municipal landfill.

### **2.3.12 Liquid Waste Exclusion Program**

The San Juan County Landfill currently employs a liquid waste management program to prevent the uncontrolled disposal of bulk liquid wastes in either the municipal or C&D waste disposal cells. In accordance with UAC R315-303-3(1)(b) and R315-315-5(1), containerized liquids larger than household size, non-containerized liquid, and sewage sludge, septic tank pumpings, or raw sewage which contain free liquids are not accepted at the facility. Only those materials which do not possess free liquids are allowed for disposal. The presence of free liquids is determined through the

application of EPA Method 9095, Paint Filter Test. The Paint Filter Test is performed by placing a 100-millimeter sample of waste in a conical, 400-micron paint filter. The waste is considered a liquid and unacceptable for disposal if it passes through the filter within five minutes. To qualify for acceptance, liquid-filled containers must be part of the household waste stream, small, and similar in size to a container which would normally be found in household waste (five gallons or less). Acceptable liquid containers must be designed to hold liquids for uses other than storage.

The liquid waste exclusion program relies heavily on the inspection of each load at the active disposal face. Privately hauled loads are visually inspected at the landfill entrance for obvious signs of liquid waste in the load. Commercial and contract waste haulers are responsible for the initial inspection during waste collection. When the waste load reaches the landfill, the landfill attendant is responsible for final inspection and determination of a particular load's suitability for disposal. Final inspection is performed when the waste is spread out at the active disposal area. The landfill manager has been trained in waste screening and identification of prohibited wastes, including the recognition of liquid-filled containers which may require segregation from the waste stream. Training documentation is included in Appendix H. The landfill manager is responsible for training other landfill employees.

In the event that a suspect container is observed at the landfill, the landfill attendant will determine whether or not the container is empty. Empty and properly vented containers that do not contain liquids or hazardous materials are accepted for disposal. In order to dispose of suspect containers or materials, the generator must be able to provide documentation of a non-hazardous designation upon request. Attendants are instructed not to open closed containers without first checking with the landfill manager.

Containers that do not meet acceptable criteria will be removed from the waste stream and returned to the generator. If the generator is unknown and the container is not empty, it will be stored in a designated fenced area until trained personnel can perform a hazardous waste determination. If the contents are determined to be non-hazardous, they will be mixed with soil and the soil and container will be disposed of on-site. If the contents are determined to be a hazardous waste, the landfill manager will make arrangements with a licensed transport and disposal facility to remove the container from the landfill premises. Notations will be made in the operating record that include a complete description of the actions taken and the final decision to accept or reject a suspect load. The record will also contain a complete description of the generator, if available, including name and vehicle description. If the suspect material is determined to be a hazardous material, the Utah Division of Solid and Hazardous Waste will be contacted.

### 2.3.13 Hazardous/PCB Waste Exclusion Program

According to UAC R315-303-4(7), an owner or operator shall not knowingly dispose, treat, store, or handle hazardous waste or waste containing PCBs. As part of a facility's Plan of Operation, all municipal solid waste landfill owners and operators must implement a program for detecting and preventing the disposal of regulated hazardous waste. The hazardous waste exclusion program must also be designed to prevent the disposal of PCB wastes as defined in UAC R315-315-7. This

Plan of Operation defines procedures that are employed at the San Juan County Landfill to prevent the receipt and disposal of hazardous waste or waste containing PCBs. The following sections describe load inspection, record keeping, training, and handling procedures employed at the San Juan County Landfill.

### **2.3.13.1     *Inspection of Incoming Loads***

As previously mentioned, all incoming loads are visually inspected at or near the active disposal area. Private haul vehicles are also inspected at the gate for the presence of prohibited materials. The landfill manager is properly trained and certified to identify regulated hazardous or PCB wastes. Training documentation is contained in Appendix H. Landfill employees are trained by the landfill manager in proper screening and identification of hazardous and PCB wastes. Loads which are suspected of containing a high liquid content in accordance with the procedures described in Section 2.3.12 will be tested on-site by EPA Method 9095, Paint Filter Test. Any loads failing the test will be rejected. The details of EPA Method 9095A are included in employee training sessions; a description of the test method is included in Appendix H.

Procedures which will be employed to determine whether a material, suspected of being hazardous, can be accepted for disposal are described below.

- Private haulers are required to wait at the gate until the contents of their loads are verified by visual inspection. Load weight is estimated based on size and content.
- Commercial loads are weighed and hauler information is recorded at the landfill gatehouse. Each commercial load is inspected after discharging at the active face. Because detailed records are kept, suspect or prohibited wastes which are discharged from haul vehicles can usually be traced back to the hauler.
- Large loads are carefully spread for observation using the landfill compactor.
- Containers with contents that are not easily identifiable, such as unmarked 55-gallon drums, will be separated if a visual inspection determines that such movement will not cause the container to rupture, and will be opened and inspected only by properly trained personnel.
- If suspect waste in private haul vehicles, commercial haul vehicles, or County haul vehicles is determined to be acceptable, it may be transferred to the working face for disposal. If suspect waste from private haul vehicles is determined to be unacceptable for disposal, the hauler will be refused at the landfill entrance. If prohibited waste is discharged by a commercial hauler, it will be handled as a hazardous material and returned to the hauler for proper management. If unacceptable waste is received in a County haul vehicle, the County will provide for proper management and disposal.

Wastes that are suspected of being hazardous will be handled and stored as a hazardous waste until proven otherwise. Tests for hazardous characteristics may be performed and typically include the Toxicity Characteristic Leaching Procedure (TCLP) and tests for corrosiveness,

flammability, and reactivity. If wastes temporarily stored at the site are determined to be hazardous and the origin of the waste is unknown, the operator will immediately contact San Juan County Fire and Emergency Services (435-587-3225, 435-459-1807) who will then be responsible for proper management of the wastes. If hazardous wastes are to be transported from the facility, they must be:

- stored at the landfill in accordance with the requirements of a hazardous waste generator;
- properly manifested;
- removed by a licensed transporter; and
- disposed of at a permitted treatment, storage, or disposal (TSD) facility.

UDEQ will be notified of the waste characterization of any rejected loads. In addition, UDEQ will be contacted to provide guidance on the proper procedures for notifying the waste generator and instructions for proper disposal.

### **2.3.13.2    *Records of Inspection***

Random, detailed inspections are performed approximately every 10 or 15 loads per commercial hauler. Records of each random inspection are maintained in the facility's operating record at the landfill gatehouse, and are available to UDEQ upon request. A copy of the random inspection form is included in Appendix G. Inspection records include the following data:

- date and time waste loads were received and inspected;
- weather conditions during inspection;
- name(s) of inspector(s);
- contents of the inspected load;
- load origin;
- vehicle owner;
- vehicle driver;
- observations made by the inspector;
- description of rejected loads; and
- rationale for rejection.

### **2.3.13.3    *Training of Facility Personnel***

The landfill manager is trained in the identification of containers and labels typically used for hazardous and PCB wastes, and is responsible for training landfill attendants. Training for hazardous material screening procedures addresses hazardous waste handling, safety precautions, and record keeping requirements. Documentation of the landfill manager's training is included with the operating record for the facility. Copies of training certificates are included in Appendix H. The training of facility personnel is an on-going process of on-the-job and in-house training.

#### **2.3.13.4 Handling Procedures for Hazardous or PCB Wastes**

In the event that landfill inspection procedures indicate the presence of regulated quantities of hazardous or PCB wastes on incoming haul vehicles, the landfill manager or his designee will refuse to accept the load and UDEQ will be notified. If regulated quantities of hazardous or PCB wastes are identified at the working disposal face, San Juan County Fire and Emergency Services (435-587-3225, 435-459-1807) will be called. Fire and Emergency Services will act as the first responder for hazardous materials, and will implement their Hazardous Materials Response Plan. Fire and Emergency Services will manage any subsequent activities related to the waste load, including transportation, storage, and containment. Landfill personnel will participate only as directed by the first responders. Following notification, it will be the responsibility of San Juan County Fire and Emergency Services to ensure that the hazardous materials are handled, stored, or transported in accordance with applicable federal and state regulations.

In accordance with 40 CFR 262.34, wastes that are determined to be hazardous may be stored at the San Juan County Landfill for up to 180 days. To satisfy this section of the federal regulations, Fire and Emergency Services personnel will perform the following tasks:

- waste will be placed in tanks or 55-gallon containers;
- the containers will be clearly labeled with the date of packaging;
- the containers will be clearly marked with the words "Hazardous Waste"; and
- the name and telephone number of the emergency response coordinator will be clearly marked on the container.

If waste is transported off-site by a hazardous waste disposal company, a provisional or one-time U.S. Environmental Protection Agency (EPA) identification number will be obtained, the waste will be packaged according to applicable Department of Transportation regulations, and the container will be properly transported and manifested to its point of destination. Proper chain of custody and manifest documents will be obtained from the hazardous materials disposal facility in order to maintain compliance with all applicable Federal and State regulations.

PCB wastes will be properly stored and disposed of in accordance with 40 CFR Part 761. At a minimum, the following actions will be taken:

- an EPA PCB identification number will be obtained;
- the PCB waste will be properly stored until transported;
- the container will be properly marked with the words "Caution: Contains PCBs"; and
- the container will be manifested for shipment to a permitted disposal facility.

#### **2.3.13.5 Notification**

Personnel at the San Juan County Landfill will notify UDEQ within 24 hours if suspected hazardous or PCB wastes are discovered during landfill operations. A record will be submitted



to UDEQ which identifies the date and time of discovery, type of material (if possible without analytical testing), probable hauler, waste quantity, and actions proposed for the removal of the material from the area of discovery. The record of notification will be entered into the facility's operating record.

## **2.4      *Monitoring and Self Inspections***

The landfill manager performs a daily inspection of the active operations area of the landfill, and a more thorough quarterly inspection of the entire landfill property. Daily inspections are informal and are performed to look for defects in the run-on/run-off control systems, scattered litter, breaches in the integrity of closed and/or covered fill areas, and any conditions which may pose a threat to public health and safety and the environment. The landfill manager immediately provides for mitigating steps to correct any unsatisfactory conditions.

The landfill manager or his designee performs detailed quarterly inspections. Any conditions that do not meet with the approval of the inspector are noted in writing. It is then the responsibility of the landfill manager to oversee the correction of unsatisfactory conditions. Records of quarterly inspections will be maintained with the Plan of Operation and will include, at a minimum, the date and time of inspection, the printed name and handwritten signature of the inspector, a notation of observations made, and the date and nature of any repairs or corrective action. A copy of the quarterly inspection form is included in Appendix G. Inspection logs are maintained with the operating record for a minimum of three years from the date of inspection.

Landfill gas monitoring is performed by the landfill manager on a quarterly basis using a hand-held AIM four gas detector or equivalent. Landfill gas monitoring is currently performed at the locations indicated on Drawing 5 (Appendices A and M) which currently exist. As landfill development progresses and additional monitoring points are created where shown on the design drawings, these points will be added to the quarterly monitoring routine. Specific gas monitoring procedures are described in section 2.5.3. Landfill gas monitoring results are reported in each annual report to UDEQ.

## **2.5      *Contingency Plans***

Contingency plans have been developed to describe organized, coordinated, and technically and financially feasible courses of action to be followed in the event of fires or explosions, a release of hazardous materials, a release of landfill gas, failure of the run-off control system, equipment breakdown, or any incident which results in the necessity to implement alternative waste handling procedures. The plans have been developed in accordance with UAC R315-302-2(d,f,j).

San Juan County developed a general emergency operations plan (including a hazardous materials response plan)\_to be implemented under the direction of San Juan County Fire and Emergency Services (435-587-3225 or 435-459-1807). It is anticipated that this plan will be invoked in the event that an incident at the landfill requires the assistance of an emergency response team.

## 2.5.1 Contingency for Fire or Explosion

San Juan County Landfill personnel are prepared to provide immediate fire suppression activities in the event of a structure fire or a fire at the active disposal face. Landfill heavy equipment and County trucks are equipped with fire extinguishers. In addition, there are fire extinguishers in the gatehouse and the maintenance shop. The landfill manager maintains a two-way radio in his County truck, enabling communication with the County dispatch center, and there is a landline telephone in the landfill gatehouse. In the event of a structure fire that is too large to handle with fire extinguishers, the landfill manager or attendant will contact San Juan County Fire and Emergency Services (435-587-3225 or 435-459-1807).

If a fire breaks out at the active face or within the waste mass, a bulldozer will be used to push nearby stockpiled soil over the smoldering or burning area. Water will be applied to waste fires as a last resort only. If the waste fire is too large to be contained with on-site resources, the landfill manager or attendant will contact San Juan County Fire and Emergency Services (435-587-3225 or 435-459-1807). Access to the critical area will be restricted until danger to public health has been eliminated. San Juan County Fire and Emergency Services will probably notify the Bluff Volunteer Fire Department, located in Bluff, Utah, approximately 15 miles south of the landfill. Estimated response time is 15 to 20 minutes. The responding fire department will assume responsibility for continued fire abatement upon arrival.

## 2.5.2 Release of Hazardous or Toxic Materials

San Juan County Fire and Emergency Services (435-587-3225 or 435-459-1807) will be contacted immediately in the event of a hazardous or toxic materials release at the landfill. Upon arrival at the site, Fire and Emergency Services will assume responsibility for material handling, containment, and transport off-site of the discharged material. Landfill personnel will not handle hazardous materials incidents. The landfill manager will serve as the landfill staff liaison with the emergency response team, and will ensure the safe evacuation of all employees and landfill customers. It is the responsibility of the landfill manager to define emergency escape routes, and to regularly inform landfill personnel of the established primary and secondary escape routes.

## 2.5.3 Landfill Gas

San Juan County monitors landfill gas concentrations in structures and disposal areas on a quarterly basis using a hand-held AIM four-gas detector or equivalent. If landfill gas is discovered in facility structures at concentrations in excess of 25 percent of the lower explosive limit (LEL) for explosive gases, or at the landfill boundary at concentrations in excess of the LEL, all operations will be halted, the Executive Secretary will be notified, and necessary steps will be taken to protect public health and safety. Within seven days of the detection of gas levels in excess of the described thresholds, the detected methane level and a description of the steps taken to protect human health will be noted in the operating record. Within 60 days of detection, San Juan County will develop a remediation plan and obtain approval from the Executive Secretary. Following approval, San Juan County will implement the remediation plan, enter it in the facility's operating record, and notify the Executive Secretary that the plan has been implemented.

## **2.5.4 Failure of Run-off Control System**

The San Juan County Landfill is operated as an area fill, whereby waste is placed within an excavated disposal cell. In areas where disposal is occurring below ground surface, precipitation and run-off flows which may contact waste at the active disposal face are contained within the disposal cell, and are not allowed to enter the facilities drainage control system and exit the site. When disposal occurs above existing ground surface, berms are constructed around the active disposal area to prevent potential contact waters from exiting the disposal cell. Site run-off from areas other than the active disposal cell is currently directed through a series of ditches and channels to informal settling and evaporation basins west and down-slope of the disposal areas. Additional ditches and channels will be constructed around the facility's perimeter as part of the operational procedures to accommodate future expansion of the Class I disposal cell. All drainage controls will be inspected after significant precipitation events for areas of excessive erosion or failure. Problem areas will be repaired in a timely manner. Based on the method of disposal within an excavated cell, either above or below existing ground surface, potential contact waters will be contained within the active cell and will not be discharged from the site. Contained contact waters will be mixed with cover soil to prevent infiltration and

## **2.5.5 Equipment Breakdown**

The San Juan County Landfill utilizes a Caterpillar 816B waste compactor and a Caterpillar D7G track dozer for most landfill duties. In the event that one of these breaks down, the other can be used for waste spreading and compaction. In the event of a total loss of landfill equipment, additional equipment is available from the County Road Department on an as-needed basis. Minor equipment repairs are performed by landfill staff on-site in the maintenance shop. Major repairs are performed at the County Road Department facility or by outside contractors.

## **2.5.6 Alternative Waste Handling**

In the event that the San Juan County Landfill is no longer able to accept waste from the service population, waste will be transferred or direct-hauled to either the ECDC Environmental Sanitary Landfill in East Carbon City, Utah, or to the Grand County Landfill in Moab, Utah. If absolutely necessary, waste may be stockpiled for a very short time on county property near the landfill, or waste collection services may be temporarily suspended, provided the duration of the emergency situation is relatively short, on a scale of days rather than weeks. In the event of a temporary emergency that only affects disposal within the municipal disposal cell, incoming waste will be diverted to the emergency disposal area northwest of the municipal cell (Drawing 5).

## **2.6 Corrective Action Plan**

Based on the information contained in the *Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill, San Juan County, Utah* (Vector, 1997) and a subsequent addendum (Vector, 1998), it is unlikely that ground water will be impacted by the operation of the San Juan County Landfill. Therefore, a corrective action plan has not been developed to account for the possibility of contaminating ground water beneath the landfill. In the event that ground water contamination is detected in the vicinity of the site or within

a reasonable distance down-gradient from the site, and provided the landfill is identified as a feasible source for the contamination, San Juan County will develop and implement a corrective action program to protect public health and safety and the environment.

## **2.7 Fugitive Dust Abatement**

The landfill access road surface is constructed of compacted re-ground asphalt from Highway 191 to the landfill entrance. Internal landfill access roads are constructed of compacted sand and gravel. Fugitive dust generation from the access road and internal site roads is minimal. Internal access roads are watered as necessary to prevent excessive generation of fugitive dust. Water is readily obtained from the County's water supply well located near the site entrance. Water is stored in a skid-mounted 3,000-gallon tank and loaded onto a tilt-frame truck for dust suppression activities.

## **2.8 Maintenance of Installed Equipment**

Based on the suspension of composite liner and ground water monitoring requirements granted by UDEQ, the design of the San Juan County Landfill does not include provisions for leachate collection or treatment, or a ground water monitoring system. Drainage channels, downdrains, and culverts installed under access roads and site drainage facilities will be inspected at least quarterly and after all significant precipitation events for blockages and will be cleared as needed. Any additional equipment installed at the site will be inspected during quarterly monitoring events.

## **2.9 Vector Control**

San Juan County employs several operational procedures designed to control vector generation and propagation at the landfill. Waste at the active face is compacted and graded on a daily basis and covered with a minimum of six inches of soil. Daily cover reduces vector access into, and harborage in, the waste mass. The application of cover soil also eliminates food sources and nesting areas. Dead animals are covered at the end of the day received to prevent the attraction of insects and other animals. In addition, proper surface grading is employed to promote drainage and prevent ponding, as well as liquid waste disposal restrictions, thereby minimizing the presence of standing water and potential insect breeding areas. Potential breeding areas will be addressed when discovered.

## **2.10 Plans for Closure and Post-Closure Care, Financial Assurance**

Plans for closure and post-closure care, in addition to their respective cost estimates, are described in Sections 5.0 and 6.0, respectively. Worksheets detailing these cost estimates are included in Appendix I. Financial assurance is discussed in Section 7.0 below.

## **2.11 Training and Safety Plan**

The landfill manager has attended several landfill courses sponsored by the Solid Waste Association of North America (SWANA) and other agencies. The landfill manager is responsible for disseminating his knowledge regarding landfill operation to other landfill employees. Documentation of employee training is included in Appendix H.

Communications at the site are facilitated by two-way radios in each county vehicle and a landline telephone in the landfill gatehouse. As a result, communication capabilities are sufficient to enable contact with Fire and Emergency Services to protect the safety of staff and users of the site. County vehicles and the landfill gatehouse are equipped with first aid kits. The landfill manager and the Director of Fire and Emergency Services will be notified (435-587-3225 or 435-459-1807) in the case of severe injuries to landfill employees or visitors, and will be responsible for ensuring the availability of proper medical care. If an emergency response team is called to the facility, landfill personnel will complete an incident report and record the date, time, type of injury, actions taken, response time of the emergency management team, and the time at which the individual was evacuated from the site.

## **2.12 Daily Cover and Compaction**

By the end of each operating day, all municipal waste received for disposal is spread in thin layers not exceeding 24 inches in thickness, and compacted using three to five passes of the landfill compactor. Compacted waste is then covered by a minimum of six inches of uncompacted soil. Construction/demolition waste is regularly compacted and covered with soil as needed to reduce the danger of fire and prevent vector harborage.

## **2.13 Record Keeping**

San Juan County maintains an operating record for the landfill at the landfill gatehouse and at the county offices in Monticello, Utah. Inspection records are maintained only at the landfill gatehouse. The operating record for the facility includes, at a minimum, the following information:

- haul vehicle information including owner's name and license number;
- type and estimated and measured weights of waste received;
- training and notification procedures;
- results of required quarterly gas monitoring;
- inspection log or summary;
- incident reports;
- deviations from the approved plan of operation; and
- this application document.

The information and documents described above comprise the operating record for the site. Any additional information which is pertinent to the operation of the landfill, or information which is required by the Executive Secretary, will also be entered into the facility's operating record. Examples of record keeping forms used at the landfill are included in Appendix G.

## **2.14 Recycling Program**

San Juan County does not currently operate a coordinated recycling program. Waste automotive and cooking oils are accepted in separate storage tanks at the landfill and periodically removed by outside entities. Waste automotive batteries are pulled from the waste stream, stored in a secure area until a significant number are collected, and then delivered to local retailers for recycling. Scrap metal and appliances are separated from the waste stream and stockpiled for eventual removal and recycling by a licensed salvage contractor. Until such time as a regional market is

established for other recyclable materials, San Juan County will promote recycling through public education.

## **2.15 Additional Operational Procedures**

Additional standards for landfill maintenance and operation are required by UAC R315-303-4, and are briefly discussed below. It is the responsibility of the landfill manager to ensure that the facility complies with the standards of this regulation.

- *Open Burning* - Open burning is prohibited at the San Juan County Landfill. Stockpiled tree clippings and yard waste is occasionally burned after a burn permit is obtained from the State of Utah.
- *Litter Prevention* - Portable litter fences are used in wind-prone areas around the active disposal cell. In addition, landfill personnel pick up litter from the site and surrounding area on a daily basis.
- *Scavenging* - Scavenging is prohibited at the San Juan County Landfill, as indicated by signs at the landfill entrance.
- *Reclamation* - On-site reclamation will be conducted in an orderly, sanitary manner, and will not interfere with site operations. Reclamation is an on-going process at the facility, and includes general site grading over old fill areas and eventual revegetation of cut and fill slopes around the perimeter of the waste disposal cell.
- *Landfill Attendant* - In accordance with R315-303-4(2)(f)(i), there is at least one person on duty at all times during normal operating hours.
- *Vector Control* - Vector control is described in Section 2.9 above.
- *Reserve Equipment* - The San Juan County Landfill is owned and operated by San Juan County and is therefore able to utilize equipment from other county departments in the event of an equipment breakdown. Contingency plans to be implemented in the event of an equipment breakdown are described in Section 2.5.4.
- *Boundary Posts* - The entire permitted area is encompassed by a four-strand barbed-wire fence. The entrance to the landfill is clearly marked.
- *Compaction and Daily Cover* - Methods for the compaction of waste and the application of daily cover are described in Section 2.12.
- *Monitoring Systems* - Ground water monitoring systems are not included as part of the site design pursuant to the technical justification presented in the request for a suspension of composite liner and ground water monitoring requirements (Appendix C). The gas monitoring program is defined in Section 4.8 of this report.
- *Recycling* - Limited recycling of select materials is performed at the San Juan County Landfill as described in Section 2.14. Currently, there is no feasible market in the area for common recyclable materials. When a market develops for additional recyclables,

containers will be provided throughout the county and at the landfill in accordance with UAC R315-303-4(6).

- *Hazardous Waste* – Disposal of hazardous waste at the San Juan County Landfill is prohibited. San Juan County employs a hazardous waste exclusion program, as described in Section 2.3.13 of this application, to prevent the disposal of hazardous materials with the municipal waste stream.

## **PART III – TECHNICAL DATA**

### **3.0 GEOHYDROLOGICAL ASSESSMENT**

The majority of the required components of a geohydrological assessment detailed by UAC R315-310-4(2)(b) are addressed in the *Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill, San Juan County, Utah* (Vector, 1997), submitted to UDEQ in December, 1997, and subsequent related correspondence. These documents are included in Appendix C, and are considered integral parts of this permit application that address the following elements of a geohydrological assessment, as defined by UAC R315-310-4(2)(b):

- faults, local and regional geology and hydrology;
- evaluation of soil types and properties, including permeability rates;
- depths to ground water or aquifers;
- direction of ground water flow; and,
- calculation of site water balance using HELP model.

The documents in Appendix C present detailed information regarding these elements of the geohydrological assessment. The remaining requirements are addressed below and include the following:

- unstable slopes, and subsidence areas on-site;
- quantity, location, and construction of any private and public wells on the site and within a 2,000 foot radius of the site;
- tabulation of all water rights for ground and surface water on the site and within a 2,000 foot radius of the site;
- identification and description of all surface waters on the site and within a one-mile radius of the site;
- background ground and surface water quality assessment; and,
- conceptual design of ground and surface water monitoring systems.

#### **3.1 Subsidence Areas and Unstable Slopes**

A detailed field investigation was performed during the development of the monitoring suspension request (Vector, 1997, Appendix C) that included a subsurface drilling and sampling program and laboratory testing and characterization of on-site soils. Information resulting from the investigation indicates that the soils beneath the landfill property are characterized by a near-surface silty sand, underlain by moderately to well-indurated lacustrine mudstones and siltstones, in turn underlain by interbedded shale and sandstone. Relatively hard, cemented layers are encountered near or at the surface at the western boundary of the Class IVb disposal cell and west of the existing municipal disposal cell. The surficial silty sand thickens to the east within the landfill footprint to more than 19 feet along the eastern property boundary.

An expansive fat clay was identified during Vector's (1997) field investigation at approximately 10 feet below the site access road near the southwest corner of the existing municipal disposal cell. Based on the design of the landfill with its base below existing ground surface, in addition to the



depth of occurrence near the predicted shallowest area of future excavation, it is not anticipated that this clay layer will create stability problems for future landfill development.

Subsidence has not been observed in old fill areas, either by subgrade settlement beneath the filled areas due to the overlying waste load or due to settlement within the waste mass itself. None of the following problem soil or rock types are known to exist anywhere within the landfill property: collapsible soil; gypsiferous soil or rock; limestone (karst); soils susceptible to piping; or areas that contain active dunes. The sandstone knob immediately north and east of the landfill is not exceedingly steep or high, and although there is a minimal potential for an occasional dislodged rock to roll down the slope toward the landfill, the potential for mass wasting is considered minimal. During post-closure, rocks which may roll down the slope will most likely be intercepted by the perimeter access road or run-on diversion channel (Drawing 5) and removed, if encountered, as a result of regular site inspections. Based on this information, the operation of the San Juan County Landfill is not likely to be affected by problems of settlement or unstable slopes or soils.

### **3.2 Wells, Water Rights, and Surface Water**

On August 7, 2002, San Juan County completed construction of a non-production well near the landfill entrance gate (refer to Drawings 3 and 5). The well will be used for fire and fugitive dust suppression, emergency service activities, and road maintenance. Details of well completion and subsurface geology encountered during drilling are discussed in Section 3.3. San Juan County obtained water rights for this well through application to the State of Utah Division of Water Rights. A computer database search through the State of Utah Division of Water Rights website did not indicate the presence of any water rights or existing or abandoned wells within a 2,000-foot radius of the landfill site, except for the County's well at the landfill. Copies of the results of the web-based water rights search, San Juan County's well installation and water appropriation documentation, and well construction logs are included in Appendix F.

Several ephemeral drainages transect the landfill property and are currently redirected around the active disposal area through the use of diversion berms, soil stockpiles, and diversion channels. Ephemeral drainages, by definition, carry water only during heavy precipitation events and times of high run-off, and then only for short durations. Based on available mapping of the area, the nearest perennial surface water is Recapture Creek, located approximately two miles east of the site.

Disposal operations employ the area fill method within an excavated cell. Any contact water resulting from precipitation falling on refuse will be confined within the current active disposal area by the limits of the excavated area and effective surface grading maintained by the landfill operator. The potential for contact water to enter nearby ephemeral drainages is negligible. Based on this, the operation of the landfill in its current location is unlikely to cause contamination to a surface water body.

### **3.3 Ground and Surface Water Quality**

As described above, there is no perennial surface water within the vicinity of the landfill. Ground water was encountered during San Juan County's 2002 installation of a non-production well just

inside the landfill entrance (Drawings 3 and 5) at a depth of 580 feet below ground surface in interbedded shale and sandstone. The depth to ground water at the southwest corner of the existing disposal cell was previously determined through a 1997 drilling investigation to be approximately 770 feet below ground surface (Vector, 1997). Although there are no wells within one mile of the landfill, there are several wells scattered throughout the region. The closest well, identified as (D-38-22)17bab by Avery (1986), is located approximately 2.5 miles southwest of the landfill. Additional wells for which published data exist are located approximately 3.3 miles north on the Ute Indian Reservation and along State Highway 262 more than 6 miles southeast of the landfill. While the information is not specific to the landfill property, it provides a reasonable estimation of local ground water chemistry. The chemistry data for each of these wells are summarized in Table 3.1, and are derived from published data by Avery (1986). Water samples collected from the County's well near the landfill entrance were tested following well installation only for the presence or absence of fecal or coliform bacteria. Test results included in Appendix F indicate there are no fecal or coliform bacteria present in the water.

### **3.4 Ground and Surface Water Monitoring Systems**

UAC R315-310-4(2)(b) requires a conceptual design of ground and surface water monitoring systems, including proposed installation methods and a vadose zone monitoring plan, where required. This permit application is submitted without provisions for a ground water, surface water, or vadose zone monitoring system. The exclusion of these provisions is supported by a technical justification previously submitted to UDEQ (Vector, 1997) as part of a request for a suspension of composite liner and ground water monitoring requirements and UDEQ's subsequent approval and issuance of permit 93-05R, included with related documentation in Appendix C of this application.

<b>TABLE 3.1 Available Ground Water Chemistry Data</b>						
Well Number	1	2	3	4	5	6
Well Location						
Township	39	40	40	38	39	39
Range	24	23	23	22	22	22
Locator (section/quarter section)	13dac	4bbc	12bad	23acb	17bab	17cbd
Distance to SJC Landfill (miles)	13	6.4	9.3	3.3	2.5	2.9
Aquifer (see Vector 1997, Appendix 3)	M	M	M	N	N	N
Date of Sample	Aug-60	May-56	Apr-73	May-80	Sep-82	Jun-82
Temperature (°C)	--	--	--	--	18.0	19.0
Specific Conductance (µS/cm)	598	--	--	360	370	400
pH (units)	7.9	--	8.8	7.6	7.8	8.0
BiCarbonate (mg/L as HCO <sub>3</sub> )	--	380	547	--	--	--
Solids (sum of constituents, dissolved, mg/L)	--	2035	1144	--	--	--
Hardness (mg/L as CaCO <sub>3</sub> )	--	354	15	--	--	--
Hardness (noncarbonate, mg/L as CaCO <sub>3</sub> )	--	42	0	--	--	--
Arsenic (dissolved, µg/L as As)	--	--	--	<20	--	--
Boron (dissolved, µg/L as B)	240	--	690	--	--	--
Bromide (dissolved, µg/L as Br)	--	--	--	--	--	--
Calcium (dissolved, µg/L as Ca)	--	71	6	--	--	--
Chloride (dissolved, mg/L as Cl)	--	374	35	--	--	--
Iron (dissolved, µg/L as Fe)	--	--	30	0	--	--
Magnesium (dissolved, µg/L as Mg)	--	43	--	--	--	--
Selenium (dissolved, µg/L as Se)	--	--	--	<10	--	--
Na + K (dissolved, mg/L as Na)	--	591	--	--	--	--
Sulfate (dissolved, mg/L as SO <sub>4</sub> )	--	769	378	--	--	--
Aluminum (total recoverable, µg/L as Al)	--	--	--	--	160	--
Antimony (total, µg/L as Sb)	--	--	--	--	<1	--
Arsenic (total, µg/L as As)	--	--	--	--	16	12
Barium (total recoverable, µg/L as Ba)	--	--	--	--	200	--
Beryllium (total recoverable, µg/L as Be)	--	--	--	--	<10	--
Cadmium (total recoverable, µg/L as Cd)	--	--	--	--	<1	--
Chromium (total recoverable, µg/L as Cr)	--	--	--	--	<10	--
Cobalt (total recoverable, µg/L as Co)	--	--	--	--	<1	--
Copper (total recoverable, µg/L as Cu)	--	--	--	--	2	--
Iron (total recoverable, µg/L as Fe)	180	--	--	--	230	--
Lead (total recoverable, µg/L as Pb)	--	--	--	--	1	--
Lithium (total recoverable, µg/L as Li)	--	--	--	--	40	--
Manganese (total recov., µg/L as Mn)	--	--	--	--	40	--
Molybdenum (total recov., µg/L as Mo)	--	--	--	--	4	--
Nickel (total recoverable, µg/L as Ni)	--	--	--	--	7	--
Selenium (total, µg/L as Se)	--	--	--	--	--	<1
Silver (total recoverable, µg/L as Ag)	--	--	--	--	<1	--
Strontium (total recoverable, µg/L as Sr)	--	--	--	--	1300	--
Zinc (total recoverable, µg/L as Zn)	--	--	--	--	20	--
NOTE: Data derived from <i>Bedrock Aquifers of Eastern San Juan County, Utah</i> (Avery, 1986)						

## **4.0 ENGINEERING REPORT**

This engineering report has been prepared in accordance with R315-310-4(2)(c) of the Utah Administrative Code (UAC). This section of the permit application includes brief descriptions of the maps, drawings, and specifications included in Appendices A and M, a description of the compliance of the site with respect to the location restrictions defined in UAC R315-302-1, and a discussion of the design and operation of the landfill. In addition, ground water monitoring, leachate collection and treatment systems, the control and monitoring of landfill gas, drainage system design and construction, and closure and post-closure design and construction are also addressed.

### **4.1 Maps, Drawings, and Specifications**

The maps and drawings required by UAC R315-310-4(2)(a and c) are included in Appendices A and M of this permit application. Drawing 1, Title Sheet and General Project Location Map, illustrates the location of the San Juan County Landfill within the State of Utah and relative to the boundary of San Juan County and nearby landmarks. Drawing 2 is a spliced copy of the United States Geological Survey *No Man's Island, Utah* and *Big Bench, Utah* (1989) 7.5 minute topographic quadrangle maps. The maps have been modified to show the landfill boundary, the zoning and land use designation of the landfill property and surrounding area, a ¼-mile radius around the landfill property, and the prevailing wind direction. There are no existing utilities or structures within ¼-mile of the site. Drawings 3 and 4 (Appendices A and M) illustrate the existing topography of the site and the locations of existing disposal areas and site facilities. The topographic base map was generated from an aerial survey performed by Olympus Aerial Surveys, Inc., of Salt Lake City on October 9, 1998. The topography of the disposal area was updated using a ground survey completed by San Juan County in 2004. Drawing 4 presents a side-by-side comparison of the original 1998 topography versus the revised 2004 topography. Drawing 5 presents the proposed final grading plan for the San Juan County Landfill. Drawing 6 provides a generalized illustration of the proposed fill sequencing of the site. Drawing 7 presents three cross sections, A-A', B-B', and C-C'; the location of each cross section is indicated on Drawing 5. Drawing 8 presents details of components of the proposed conceptual landfill design. Drawing 9, in addition to Figure J1 in Appendix J, illustrates the hydrologic sub-area layout used in the design of the surface water drainage system for the site.

### **4.2 Location Standards**

According to UAC R315-302-1, all applicable solid waste facilities must satisfy a number of criteria regarding the location of the facility. The San Juan County Landfill is considered an existing facility by the Utah Department of Environmental Quality (UDEQ), and is therefore subject to location restrictions pertaining to airports, floodplains, and unstable areas in accordance with UAC R315-302-1(3). However, because this renewal application details a vertical expansion of the existing site, the landfill is also subject to the remaining location restrictions regarding land use compatibility, geology, surface water, and ground water. The compatibility of the location of the San Juan County Landfill with respect to these restrictions is discussed below.

#### 4.2.1 Land Use Compatibility

The San Juan County Landfill is not located within ¼-quarter mile of any of the following (refer to Drawing 2):

- National, state or county park, monument, or recreation area;
- Designated wilderness or wilderness study area;
- Wild and scenic river area;
- Existing permanent dwellings, residential areas, or other incompatible structures such as schools, churches; or
- Historic structures or properties listed or eligible to be listed in the State of National Register of Historic Places.

The landfill is not located within farmland designated as “prime,” “unique,” or “of statewide importance,” as demonstrated by correspondence from the United States Department of Agriculture Natural Resources Conservation Service (NRCS), included in Appendix F.

The landfill is located within a region identified as potential habitat for the Black-footed Ferret, an endangered species. However, a determination of the presence of endangered species is required as part of BLM’s Environmental Assessment (EA) process for public land transfers, as is a site survey for archaeological or cultural artifacts. During the County’s acquisition of the property from BLM in 1995, BLM surveyed a total of 880 acres of land containing the current 390-acre landfill property. As a result of the site survey and recommendations from the State Historic Preservation Office and the Division of Wildlife Resources, the landfill property was subsequently cleared for transfer of ownership to San Juan County.

The San Juan County Landfill is not located within ten thousand feet of any airport runway end. The nearest airport is located more than 11 miles north of the site near Blanding, Utah.

Based on the information presented above, the location of the San Juan County Landfill satisfies the general land use compatibility restrictions specified in UAC R315-302-1(2)(a).

#### 4.2.2 Geology

The San Juan County Landfill is not located in an area prone to subsidence, a dam flood area, above an underground mine, above a salt dome, above a salt bed, or on or adjacent to geologic features which could compromise the structural integrity of the facility. The following sections describe the compliance of the landfill site with respect to Holocene faulting, seismic impact zones, and unstable areas.

*Holocene Faulting* - The nearest fault to the landfill was identified by Vector (1997) as approximately 40 miles north of the landfill in the Paradox Basin. Therefore, the site satisfies the location criteria with respect to offset from Holocene faults.

*Seismic Impact Zone* - Utah solid waste rules require that a landfill not be located in a seismic impact zone unless the owner or operator demonstrates that all containment

structures, including liners, leachate collections systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. A site is considered to be in a seismic impact zone if there is a 10 percent or greater probability that the maximum horizontal acceleration will exceed 0.10g in 250 years. Maps within the U.S.G.S. Open File Report 82-1033 entitled *Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico* (Algermissen, 1990) indicate that the San Juan County Landfill is located within an area with a 10 percent probability of exceeding a horizontal ground acceleration of 0.08g in 250 years. As a result, the site is not located within a seismic impact zone.

Unstable Areas - A detailed field investigation was performed by Vector (1997, in Appendix C) during the development of the monitoring suspension request and included a subsurface drilling and sampling program and laboratory testing and characterization of on-site soils. Information resulting from the investigation indicates that the soils beneath the landfill property are characterized by a near-surface silty sand, underlain by moderately to well-indurated lacustrine mudstones and siltstones, in turn underlain by interbedded shale and sandstone. Relatively hard, cemented layers are encountered near or at the surface at the western boundary of the Class IVb disposal cell and west of the municipal disposal cell.

The surficial silty sand thickens to the east within the landfill footprint to more than 19 feet along the eastern property boundary. Drill logs from the 2002 water well installation described in Section 3.2 support the vertical geologic section described in Vector (1997).

An expansive clay was identified during Vector's (1997) field investigation at approximately 10 feet below the site access road near the southwest corner of the existing municipal disposal cell. Based on the design of the landfill with its excavated base below existing ground surface, and based on the depth of the clay layer near the predicted shallowest area of future excavation, it is not anticipated that this clay layer will create stability problems for future landfill development.

Subsidence has not been observed in old fill areas, either by soil settlement beneath the filled areas due to the overlying waste load, or due to settlement within the waste mass itself. None of the following problem soil or rock types are known to exist anywhere within the landfill property: collapsible soil; gypsiferous soil or rock; limestone (karst); soils susceptible to piping; and areas that contain active dunes. A sandstone knob immediately north and east of the landfill is not excessively steep or high relative to the landfill, and although there is a minimal potential for an occasional dislodged rock to roll down the slope toward the landfill, the potential for mass wasting is considered minimal. Large soil stockpiles between the knob and the active disposal area (as high as 10 feet above existing ground surface) will protect the landfill during the operational life. Based on this information, the San Juan County Landfill is not located within an unstable area.

### 4.2.3 Surface Water

The following sections describe the compliance of the San Juan County Landfill with location restrictions pertaining to surface water.

Surface Water - The land surrounding the San Juan County Landfill is not used by a public water system for watershed control or municipal drinking water purposes. Several small ephemeral drainages pass through and around the landfill. These drainages, by definition, carry water only during heavy precipitation events, and then only for short durations. All potential surface water, whether confined to ephemeral drainages or occurring as sheet flow, will be redirected around the landfill property as described in Section 4.9 of this report. Any waters that are redirected around the site will not be allowed to come into contact with any possible contaminants resulting from the operation of the landfill. Run-off from active disposal areas is contained within the immediate area by temporary berms and selective grading and is not allowed to exit the landfill property. As a result, the location of the landfill is unlikely to cause contamination to a lake, reservoir, or pond, and therefore satisfies the requirements imposed by UAC R315-302-1(2)(c)(i).

Floodplains - All land within San Juan County has been designated as flood hazard Zone C by the Federal Insurance Administration. Areas designated as Zone C are defined as areas of minimal flooding. Documentation from the National Insurance Administration is included in Appendix F. The San Juan County Landfill is not located within a 100-year floodplain and satisfies the floodplain location restriction mandated by UAC R315-302-1(2)(c)(ii)

Wetlands - The San Juan County Landfill is not located in an area which is inundated or saturated by surface or ground water at a frequency and duration sufficient to support under normal conditions a prevalence of vegetation typically adapted for life in saturated soil conditions. In addition, a site investigation of the landfill property has indicated that unsaturated conditions exist in the subsurface to depths of at least 580 feet. Drill logs are presented in Vector (1997), and included with this permit application in Appendices C and F. The landfill property does not meet the definition of a wetland specified in UAC R315-301-2(81), and therefore satisfies the location restriction pertaining to wetlands mandated by UAC R315-302-1(2)(d).

### 4.2.4 Ground Water

Depth to ground water below the base of the landfill has been documented to be at least 580 feet (Appendix F). Based on the depth to ground water and UDEQ approval for a suspension of ground water monitoring requirements, the ground water location restrictions defined in UAC Section R315-302-1(2)(e) do not apply to the San Juan County Landfill.

## 4.3 Site Life Calculations

In order to estimate the expected remaining active life of the site, the following assumptions were made:

- The final waste footprint covers a composite total (municipal and C&D waste) of approximately 27.3 acres, as delineated on Drawing 5;

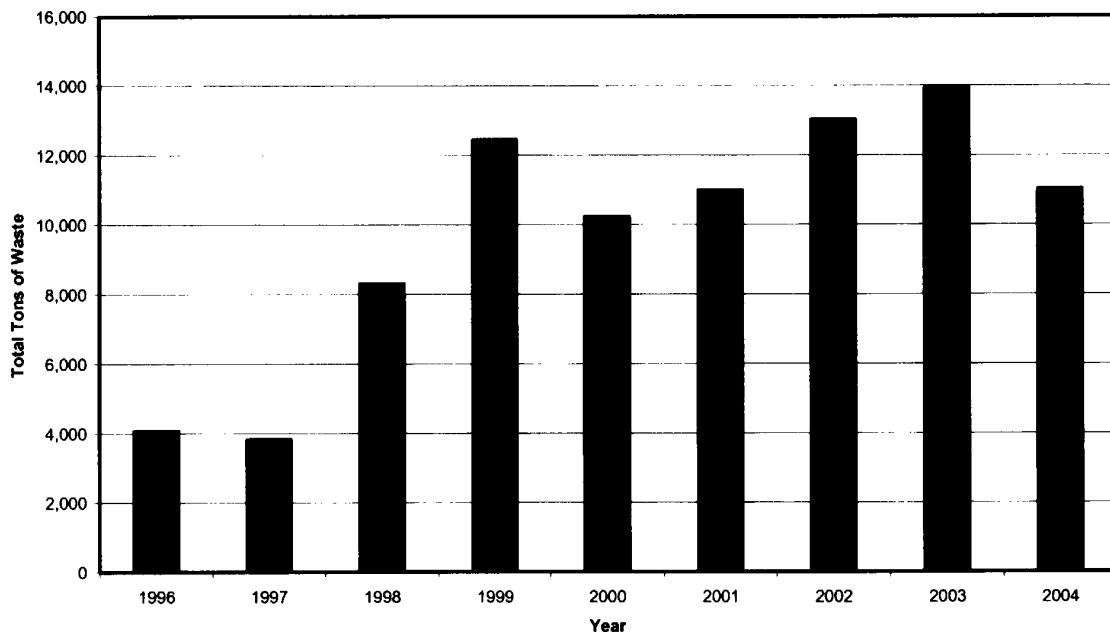
- The future waste stream growth rate is the same as the predicted average annual growth rate for San Juan County for 2000-2050, as defined by the Utah Governor's Office of Planning and Budget;
- Waste is compacted using a landfill compactor to approximately 1,100 lbs/yd<sup>3</sup> (from the Caterpillar Handbook for an 816B landfill compactor);
- Waste to soil ratio is 3:1;
- Depth of excavation averages approximately 15 feet over the entire waste footprint.

Loading rate calculations based on these assumptions are included in Appendix K. Based on the final landfill design as presented on Drawing 5 (Appendices A and M), the remaining capacity of the site as designed is approximately 1,946,800 cubic yards of waste and cover soil. Assuming a waste to soil ratio of three waste to one soil (3:1), the remaining disposal capacity of the site will accommodate approximately 1,460,100 cubic yards of waste and 486,700 cubic yards of cover soil. Based on the remaining site capacity and the loading rate calculations (Appendix K), the revised designed will provide for approximately 51 additional years of disposal capacity, through the year 2055.

Loading rate calculations presented in the June 1999 permit renewal application predicted a site life of 77 years through the year 2076. These earlier calculations also used predicted population growth rates from the Office of Planning and Budget and started with an annual waste generation rate based on an average of total annual waste received for the years 1996 through 1998, or 5,473 tons. The revised calculations presented herein reflect the increase in total annual waste received after 1998, and start with an average of waste received between 2001 and 2004, or 12,337 tons, significantly higher than the initial disposal rate used in the 1998 loading rate calculations. As a result, even with the increased disposal capacity from the vertical expansion, the predicted site life is approximately 20 years less than previously predicted. Actual reported annual waste tonnages received at the San Juan County Landfill are illustrated in Figure 4.1 below.



**FIGURE 4.1**  
**San Juan County Landfill**  
**Waste Received 1996 through 2004**



#### **4.4 Design and Operation**

The San Juan County Landfill began disposal operations in January 1996 in a pre-excavated disposal cell as defined on Drawing 3. The initial disposal cell was approximately 600 by 600 feet, roughly two-thirds of which has already been utilized. As illustrated on Drawing 5 (Appendices A and M), the landfill closure design consists of a series of ridges and swales across the top surface of the waste mass. Landfill sideslopes are configured at a maximum grade of 3:1, horizontal to vertical, while top deck slopes range from 4 to 6 percent, considerably steeper than the minimum requirement of 2 percent. As designed, the landfill should accommodate future settlement and consolidation within the waste mass.

As illustrated on Drawings 3 and 4, the existing limit of waste placement in the municipal disposal cell covers approximately 4.0 acres, while the existing limit of waste placement in the C&D disposal cell covers approximate 0.75 acres. The proposed final limit of waste placement includes approximately 25.8 acres for the Class I municipal waste disposal facility, and approximately 1.5 acres for the Class IVb construction/demolition waste disposal facility. Current operating plans include the expansion of the existing cell to the north and east to maximize available disposal capacity within excavatable soils. Disposal operations will continue within the existing excavated cell for several more years. As the southern edge of the waste mass approaches the southern boundary of the excavated cell, the cut and fill method will be employed to efficiently expand the

disposal area further to the south and eventually east, as illustrated on the fill sequencing plan presented on Drawing 6.

The landfill will generally be constructed in lifts of 10 to 15 feet in total thickness. At the end of each operating day, municipal waste is spread and compacted in thin layers not exceeding two feet in thickness. Daily cover material is obtained from stockpiled soil near the active face or from the migrating cell excavation wall and spread over the compacted waste to a minimum depth of six inches. Cover soil will be applied to exposed or combustible construction and demolition waste on an as-needed basis to avoid a fire hazard.

The final cover will be constructed in accordance with UAC R315-303-3(4), and will consist of an 18-inch low permeability infiltration layer and an 18-inch erosion layer. The infiltration layer will have a permeability equal to  $1 \times 10^{-5}$  cm/sec. The construction of the final cover layer is detailed in Sections 5.1 and 5.2. Fine-grained material encountered during excavation will be handled as described in Section 4.6. The erosion layer will consist of native soils capable of sustaining vegetation common to the area. The final cover layer will be revegetated according to a plan developed or recommended by the Natural Resources Conservation Service or Bureau of Land Management. The final cover will be graded to prevent ponding and minimize infiltration of precipitation.

The proposed closure design, including final cover elevations and the locations of all proposed site facilities are illustrated on Drawing 5 (Appendices A and M). It is anticipated that closure construction will occur on the order of once every ten years. The largest area that will require closure at any given time during the life of the site will be approximately 4.5 acres, or one-sixth of the total site area allocated for waste disposal.

#### **4.5      *Equipment***

All site operations except occasional dust suppression activity are performed with on-site equipment, including the following:

- 1995 Chevrolet pickup;
- 1989 Dodge Ram pickup;
- 2004 Dodge Dakota pickup;
- 1995 Caterpillar 816B landfill compactor;
- Caterpillar 623F paddle-wheel scraper;
- Caterpillar 140G grader;
- Caterpillar D-6N track dozer;
- Case Super L backhoe;
- 2001 Peterbuilt tilt-frame truck;
- 3,000-gallon skid-mounted water tank; and,
- Two diesel-powered generators.

Additional heavy equipment is available from San Juan County on an as-needed basis.

#### **4.6 Borrow Sources**

Borrow material for daily and final cover is currently derived from stockpiles generated during the initial cell excavation. As the southern edge of the waste mass approaches the southern boundary of the current excavated cell, the cut and fill method will be employed to efficiently expand the disposal area. This method involves the excavation of daily cover soil from one side of the excavation while waste deposition occurs on the other side. In this way, daily cover soils are only handled once, and haul distances are minimized. Fine-grained soils encountered during cell construction are stockpiled in a separate area for eventual use in final cover construction.

#### **4.7 Ground Water Monitoring and Leachate Collection**

UDEQ granted approval for a suspension of composite liner and ground water monitoring requirements based on San Juan County's submittal of the *Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill, San Juan County, Utah* (Vector, 1997). As required by both Sections R315-303-3 and R315-308-1, the technical justification presented in that report (Vector, 1997) demonstrates that, based on site-specific physical and operational characteristics, operation of this site without a composite liner system or a ground water monitoring system is consistent with the protection of public health and the environment, and the protection of waters of the state from degradation by pollutants or contaminants. The suspension request demonstrated that the San Juan County Landfill is unlikely to produce a significant amount of leachate or pollute or degrade waters of the state, and therefore will not require monitoring of ground water or the installation of a liner system. As a result, the landfill design does not include provisions for a ground water monitoring or leachate collection, treatment, and disposal system.

The facility was originally permitted with a compacted clay liner and leachate collection system, both of which were installed beneath the existing waste footprint. The sump was originally at the western extent of the waste footprint, as illustrated on Drawing 4. Regular inspection and monitoring of the leachate collection sump since the first receipt of waste did not result in evidence of leachate generation within the waste mass. In its 1999 renewal permit application, San Juan County indicated its intention to continue to regularly monitor the leachate collection sump until such time as the lateral progression of waste deposition prevents further monitoring. San Juan County subsequently abandoned the leachate collection sump and extended the waste fill over the area. In accordance with UDEQ's previous approval of the suspension of liner requirements (Appendix C), San Juan County has not provided for future leachate generation monitoring.

#### **4.8 Landfill Gas Control and Monitoring**

Landfill gas monitoring is performed at the site on a quarterly basis. Because of the relatively low permeability and transmissivity of the soils that immediately underlie the site, gas monitoring wells have not been proposed. Instead, specified locations around the site are analyzed utilizing a hand-held AIM four-gas detector or equivalent that is capable of detecting the concentration of landfill gases in air. The instrument is capable of determining if landfill gas has exceeded 25 percent of its lower explosive limit at each measuring point. If landfill gas monitoring indicates a concentration

in excess of 25 percent of the lower explosive limit (LEL) in facility structures or 100 percent of the LEL at the site boundary, the contingency plan described in 2.5.3 will be initiated. Gas monitoring locations are illustrated on Drawing 5 and include monitoring points around the site perimeter, near the active face, around old and new fill areas, and inside the gatehouse and maintenance building. Monitoring points which do not currently exist as delineated on Drawing 5 will be added to the active monitoring list as the facility expands.

#### **4.9 Run-on/Run-off Control Systems**

The stormwater control system proposed for the facility was designed to accommodate predicted run-on and run-off flows resulting from a 25-year, 24-hour storm event. A detailed discussion of site hydrology and hydraulics is included in the Drainage Report presented in Appendix J. Details and schematic cross sections of site drainage controls are included on Drawing 8 (Appendices A and M).

Surface run-off within each top-deck drainage basin is routed to a central swale and then to a headwall diversion berm near the downstream slope crest. The diversion berms route flows into overside downdrain culverts which direct flows to the perimeter drainage channel below. Top-deck ridge sideslopes vary from 4.5 percent to 6 percent, while central swale grades vary from 4.0 percent to 6 percent. Run-off flows originating from the top-deck are combined in the perimeter channels with sideslope run-off and routed through any of a number of drop inlet and culvert combinations to natural drainages outside the waste footprint.

Five culverts will be installed in strategic locations around the southern and western perimeter of the landfill to direct run-off from the closed surface of the landfill away from the site. All culverts and overside drains are specified with a minimum diameter of 18 inches to facilitate long term maintenance. Each of the perimeter culverts routes run-off flows under the perimeter access road and into existing natural drainages. The relatively high number of storm flow exit points (5 culverts) distributing stormwater generated within the facility's footprint after closure minimizes the effect of the facility on the overall drainage pattern and sediment generation characteristics of the area. As a result, sedimentation basins are not proposed.

An exterior drainage diversion channel will be constructed up-gradient from the landfill and will intercept and redirect potential run-on flows to either side of the landfill and into existing natural drainages downstream of the facility. Current off-site flows are directed around the disposal cell by the presence of large soil stockpiles and a temporary diversion channel located up-gradient from the landfill.

## **5.0 CLOSURE PLAN**

This Closure Plan for the San Juan County Landfill was developed in accordance with the Utah Administrative Code (R315-302-3). Landfill closure activities will be completed in accordance with the schedule and requirements of this plan following approval by UDEQ. Closure activities will be performed in such a way as to facilitate the accomplishment of the following goals:

- minimize the need for further maintenance;
- minimize or eliminate threats to human health and the environment from post-closure escape of solid waste constituents, leachate, landfill gases, contaminated run-off or waste decomposition products to the ground, ground water, surface water, or the atmosphere; and,
- adequately prepare the facility for the post-closure period.

This Closure Plan and documentation of any future modifications of this plan will be maintained in the landfill operating record at the landfill office; an additional copy will be maintained in the San Juan County offices in Monticello, Utah.

### **5.1 Elements of Closure**

The County will install the prescriptive final cover layer over filled areas on the order of once every 10 years. Closure activities will be initiated when a particular cell within the proposed landfill footprint (Drawing 6) reaches design height and comprises a sufficient surface area to make final cover installation feasible and economical. The size of each closed cell will cover approximately one sixth of the proposed final landfill footprint, or approximately 4.5 acres. All equipment which will not be used on-site during the post-closure period will be removed. Structures which remain at the site after the final receipt of waste, and which will not be an integral part of post-closure site maintenance, will be dismantled and removed from the site. Any soil contamination remaining after the final receipt of waste will be removed, treated, or disposed of according to applicable regulations. Following the final receipt of waste, any remaining stockpiles of recyclable or other stored materials will be removed from the site.

Rough contouring will be performed throughout the life of the site as a normal function of daily operations. Following the general site cleanup described above, final contouring will be performed using native soils to establish a suitable foundation for final cover construction. The combined interim cover and foundation layer thickness is estimated to be a minimum of 12 inches of compacted native soils available on-site. Most of the construction of the interim cover/foundation layer will be completed during the operating life of each cell, and is therefore not considered to be a closure activity. Once a suitable foundation has been established for final cover construction, the area to be closed will be surveyed to establish base elevations for final cover layer construction.

An 18-inch infiltration barrier layer will be installed over the foundation layer in accordance with UAC R315-303-3(4)(a). Due to the presence of a compacted clay liner under the first disposal cell at the site, UAC R315-303-3(4)(a)(ii) requires that the final cover infiltration barrier over the lined area be constructed to achieve a permeability equal to or less than the permeability of the compacted clay liner, or approximately  $1 \times 10^{-7}$  centimeters per second (cm/sec). However, the

original EPA rule upon which UAC R315-303-3(4)(a)(ii) is based was intended to prevent the "bathtub effect," which results in the collection of fluid within the landfill by allowing more infiltration through the final cover than the bottom liner of a landfill. Because the clay bottom liner will not be extended and future expansion areas will be constructed without a bottom liner system, the presence of a small section of lower-permeability liner within the much larger waste footprint will not result in the formation of a "bathtub". In addition, landfill personnel monitored the leachate collection sump constructed as part of the clay liner system from the beginning of disposal operations at the site until the sump was covered by disposal activities. Leachate was never observed in the leachate collection system. Based on these facts, San Juan County plans to install the infiltration barrier layer with a less-restrictive maximum permeability of  $1 \times 10^{-5}$  cm/sec.

Following placement and compaction of the low permeability layer, the area undergoing closure construction will again be surveyed to verify a minimum infiltration barrier layer thickness of 18 inches, and final slope grades in accordance with the approved closure design. The hydraulic conductivity of the low permeability layer will be field-tested and certified to be within acceptable limits.

All materials and performance testing will be performed as part of a Construction Quality Assurance (CQA) closure certification program. Laboratory soil testing will be used to establish the field test criteria based on available soil stockpiles prior to closure construction. The Closure Certification Report will include the material characteristics for the soil used as the low permeability layer, as well as the procedures and results of the field methods used during the CQA Program. Field observations and laboratory analyses presented in Vector (1997, Appendix C) indicate that a sufficient volume of low permeability material exists on-site to construct the infiltration barrier layer.

Following the construction and certification of an approved infiltration barrier layer, a minimum of 18 inches of native soil will be placed over the infiltration barrier layer in accordance with UAC R315-303-3(4)(b). The thickness of the erosion layer was determined based on frost penetration depth calculations which utilize a method developed by the U.S. Army and Air Force for cold region engineering (U.S. Army, 1988). The method is also used by the Utah Department of Transportation in highway design within the state of Utah. Calculations were performed for a range of soil moisture values from 10 to 20 percent by weight using daily average temperature data for Blanding obtained from the Western Regional Climate Center web site. A maximum frost penetration depth of 19 inches was predicted for the lowest moisture content (10%). However, because the San Juan County Landfill is situated at a lower elevation than Blanding, it is likely that the average daily temperatures at the landfill will be higher than those recorded for Blanding, and that the actual frost penetration at the landfill will therefore be less than predicted using Blanding temperature data. Based on this data, the erosion layer has been designed with a total thickness of 18 inches. Frost penetration depth calculations have been included in Appendix K.

The erosion layer will be capable of sustaining native plant growth and preventing excessive amounts of erosion. The layer will be broadcast, drill-seeded or hydroseeded with a seed mixture

designed or recommended by United States Department of Agriculture Natural Resource Conservation Service (NRCS) or Bureau of Land Management (BLM).

All drainage channels will be constructed as illustrated on Drawings 5 and 9 (Appendices A and M). The drainage channels will collect and control potential surface water run-on and run-off, thereby contributing to the maintenance of final cover integrity and preventing a washout of waste due to uncontrolled run-off during precipitation events. A final cover constructed in accordance with the design standards set forth in UAC R315-303-4, presented in Section 4.4 of this report and illustrated on Drawing 8, will be sufficient to minimize the infiltration of surface waters through the underlying waste mass.

## **5.2 Closure Design**

The final cover will be constructed in accordance with UAC R315-303-3(4), and will consist of an 18-inch low permeability infiltration layer and an 18-inch erosion layer. As described above, the infiltration layer will have a maximum permeability of approximately  $1 \times 10^{-5}$  cm/sec. The erosion layer will consist of native soils capable of sustaining vegetation common to the area. The final cover layer will be revegetated according to a plan developed or recommended by the NRCS or BLM. The final cover will be graded to prevent ponding and minimize infiltration of precipitation.

The proposed closure design is illustrated on Drawing 5 (Appendices A and M). The closure plan covers a proposed final waste footprint encompassing approximately 27.3 acres of the landfill property. As described above, the largest area that will require closure at any given time during the life of the site will be approximately 4.5 acres, or one-sixth of the site area allocated for waste disposal. The final topography of the closed landfill was designed to blend with the surrounding topography and provide for a minimum final grade of two percent on all slopes. As illustrated on Drawing 5 (Appendices A and M), the design consists of a series of ridges and swales across the top surface of the waste mass. Landfill sideslopes are configured at a maximum grade of 3:1, horizontal to vertical. The design slope grades are considerably steeper than the minimum requirement of two percent, and should accommodate future settlement and consolidation within the waste mass. The post-closure configuration of the run-on and run-off control system is described in Section 4.9 of this report.

## **5.3 Site Capacity**

The San Juan County Landfill began disposal operations in January 1996 in a pre-excavated disposal cell as defined on Drawings 3 and 4. The initial disposal cell was approximately 600 by 600 feet, approximately two-thirds of which has already been utilized. Current operating plans include the expansion of the existing cell to the north and east to maximize available disposal capacity within excavatable soils. Disposal operations will continue within the existing cell for several more years. As the southern edge of the waste mass approaches the southern boundary of the excavated cell, the cut and fill method will be employed to efficiently expand the disposal area to the south and eventually east, as illustrated on Drawing 6.

Based on the assumptions and calculations presented in Section 4.3 of this report, the remaining capacity of the site provides for approximately 1,946,800 cubic yards of waste and cover soil. Assuming a waste to soil ratio of three waste to one soil (3:1), the remaining disposal capacity of the site will accommodate approximately 1,460,100 cubic yards of waste and 486,700 cubic yards of cover soil. Based on the remaining site capacity and the loading rate calculations (Appendix K), the proposed designed will provide for approximately 51 additional years of disposal capacity through the year 2055.

## **5.4 Closure Schedule**

San Juan County will notify the Executive Secretary of the intent to close the landfill and implement the approved closure plan a minimum of 60 days prior to the projected final receipt of waste. Within thirty (30) days after the final receipt of waste, San Juan County will begin implementing the closure plan, and will complete closure activities within 180 days of initiation. Following the completion of closure activities, San Juan County will submit to the Executive Secretary a set of as-built drawings of final closure construction signed by a professional engineer registered in the State of Utah. San Juan County will also provide certification of the compliance of final closure construction with the approved closure plan. The certification will be signed by a County representative and certified by a professional engineer registered in the State of Utah.

## **5.5 Closure Costs**

The closure cost estimate has been prepared in accordance with the requirements of UAC R315-309-2 of the Utah Solid Waste Permitting and Management Rules. The cost estimate presents detailed costs to perform closure construction for the largest area that will require closure during the projected life of the site. Given the projected remaining 51-year life of the site and the final design configuration, it is anticipated that closure construction will occur on average approximately once every 10 years. Disposal Cell 1 on Drawing 6 (Appendices A and M) includes the existing in-place waste and the volume of waste projected to be deposited over the next 5 years. Cell 1 plus the total area of the construction/demolition cell is considered to be the largest area requiring closure during the life of the site.

The cost estimate has been prepared using reasonable estimates of unit costs from local and regional contractors and actual construction bids costs for similar earthworks and heavy construction projects. The cost estimate, originally based on 1999 dollars, has been adjusted for inflation for each intervening year and projects a total cost to close Cell 1 and the C&D cell as designed of \$310,129. A 10 percent contingency has been built into the final estimate to account for variances in unit costs and unforeseen circumstances. The cost estimate and inflation adjustments are presented in detail in Appendix I.



<b>Table 5.1. Closure Construction Cost Summary</b>	
<b>Item</b>	<b>Cost</b>
1.0 Site Security and Facilities – Existing or Installed During Site Life	\$ 0
2.0 Environmental Control Systems – Drainage System Construction	\$ 54,800
3.0 Final Cover Construction – MSW Disposal Cell	\$ 205,829
4.0 Final Cover Construction – Construction/Demolition Disposal Cell	\$ 49,500
<b>TOTAL</b>	<b>\$ 310,129</b>
See Appendix I for detailed cost estimates.	

## **5.6 Final Inspection**

A final report will be prepared following the completion of closure construction. The report will be certified by an engineer registered in the State of Utah, and will present laboratory and field test data which support the conformance of the final cover installation and closure activities with the Utah solid waste management regulations and the approved Closure Plan. The report will also include final closure drawings certified by a Utah-registered professional engineer which represent the final, as-built closure condition of the site. The Executive Secretary will be notified of the completion of closure activities and arrangements will be made for a final inspection by UDEQ. Following final approval by UDEQ, the post-closure maintenance plan will be initiated pursuant to the approved Post-Closure Plan, outlined in Section 6.0 of this permit application.

## **6.0 POST-CLOSURE PLAN**

This Post-Closure Plan has been developed to detail post-closure maintenance and monitoring activities for the San Juan County Landfill in accordance with UAC R315-302-3. All post-closure maintenance and monitoring will be performed in accordance with this plan and any future approved modifications to this plan. Based on the approval of the *Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill, San Juan County, Utah* (Vector, 1997), the design of the San Juan County Landfill does not include provisions for a ground water monitoring or leachate collection or detection system. Accordingly, this post-closure plan does not address ground water monitoring or leachate collection or detection system monitoring.

San Juan County can be contacted during the period of post-closure regarding issues that concern the landfill at the following address.

San Juan County Offices  
117 South Main Street, #202  
Monticello, Utah 84535  
(435) 587-3225

### **6.1 Monitoring and Maintenance Activities**

As described above, this application is submitted without provisions for ground water monitoring or leachate collection or treatment systems. Landfill gas will be monitored on a quarterly basis during the active life of the landfill, as discussed in Section 4.8 of this document. The monitoring frequency will be continued on a quarterly basis during the post-closure period at all monitoring points established throughout the life of the facility. If continued monitoring at the facility indicates that the waste mass has stabilized and does not pose a threat to human health or the environment, San Juan County may petition the Executive Secretary for a decrease in the length of the post-closure monitoring period, or a decrease in the frequency of monitoring events.

During the post-closure period, the general condition of the final cover, the site-wide drainage control system, and the perimeter fencing will be inspected on a semi-annual basis and after every major precipitation event for evidence of the effects or erosion, settlement or subsidence causing damage to the drainage conveyance system or a breach of the integrity of the final cover layer. Necessary repairs will be made as soon as is practicable.

### **6.2 Post-Closure Schedule**

The post-closure maintenance period will begin immediately following the completion of the closure activities described in Section 5.0 of this application. Post-closure activities will continue for a period of 30 years or an alternative period established by the Executive Secretary. If, during the post-closure period, monitoring activities indicate that the site has stabilized and does not pose a threat to human health or the environment, San Juan County may petition the Executive Secretary for a decrease in the length of the post-closure monitoring period.

Following completion of the post-closure monitoring period as determined by the Executive Secretary, San Juan County will submit to the Executive Secretary a certification, signed by a representative of the County and a Utah registered professional engineer, which states why post-closure monitoring activities are no longer necessary. After obtaining final approval from the Executive Secretary, post-closure monitoring activities will be discontinued.

### **6.3 Record Modifications**

Plats and a statement of fact concerning the locations of all waste disposal cells at the site will be recorded on the landfill property's record of title with the San Juan County Recorder within 60 days after the completion of all closure activities. The notation will serve to inform any potential purchaser of the property that the land has been used as a landfill, and that its future use may be restricted by local land use or zoning regulations. San Juan County will notify the Executive Secretary when the deed notation has been recorded.

### **6.4 Post-Closure Costs**

A detailed post-closure cost estimate was prepared in accordance with the requirements of UAC R315-309-2 of the Utah State Solid Waste Permitting and Management Rules. Several assumptions were necessary to project post-closure maintenance costs. These included semi-annual inspections of the integrity of the final cover and general site condition, and quarterly monitoring for landfill gas. In addition, the cost estimate was calculated assuming a third party would be hired to perform the inspections and monitoring. The cost estimate for annual post-closure care, originally based on 1999 dollars, has been adjusted for inflation for each intervening year and is summarized in Table 4.1 below. The cost estimate and inflation adjustments are presented in detail in Appendix I. A 10 percent contingency has been built into the cost estimate. Projected fund withdrawals to support post-closure activities are discussed in Section 7.0.

<b>Table 6.1. Post-Closure Monitoring and Maintenance Cost Summary</b>	
<b>Item</b>	<b>Cost</b>
1.0 Site Facilities – Fence and Access Road Repairs	\$ 1,625
2.0 Environmental Control Systems – Gas Monitoring and Drainage System Repair	\$ 4,770
3.0 Final Cover System – Inspection and Repair	\$ 2,980
<b>TOTAL</b>	<b>\$ 9,375</b>
<b>TOTAL for 30-year POST-CLOSURE PERIOD</b>	<b>\$281,250</b>
See Appendix I for detailed cost estimates.	

## **7.0 FINANCIAL ASSURANCE**

In providing for financial assurance, solid waste regulations require the consideration of third-party closure construction and post-closure monitoring costs for the largest area of the landfill that will require closure at any given time during the life of the landfill. As detailed in the Closure Plan, it is anticipated that closure construction will occur on average approximately once every 10 years. According to the proposed Closure Plan, the largest area requiring closure at any time will be the area of municipal disposal Cell 1, the largest disposal cell illustrated on Drawing 5 (Appendices A and M), plus the entire C&D waste disposal cell. The two areas comprise approximately 8.8 acres, or one-third, of the total 26.9-acre waste footprint.

Detailed closure and post-closure cost estimates are presented in Appendix I. Total closure construction costs for Cell 1 and the C&D cell are estimated to be approximately \$310,129, revised upward from the original 1999 cost estimate of \$280,900 to account for inflation. Annual post-closure maintenance costs are estimated to be approximately \$9,375 per year or a total of \$281,250 for the 30-year post-closure period, also revised upward from the 1999 cost estimate of \$252,700. Calculated inflation rates and selected revised unit rates are summarized in table format at the end of Appendix I. According to UAC R315-309-1, the total amount of required financial assurance must include the closure construction and post-closure costs depicted in Sections 5.5 and 6.4, or a grand total of \$591,379. In addition, UAC R315-309-3(3)(c)(i) requires that these funds be available within five years of permit approval.

San Juan County established a closure/post-closure account through the State of Utah Public Treasurers' Investment Fund (PTIF) to provide for closure construction and post-closure maintenance in accordance with the original landfill design and permit 93-05. Subsequent deposits were made in 2000 and periodically since that time to maintain compliance with required funding. The current balance in the account is approximately \$547,000; average annual earnings range from approximately 2 to 7 percent (based on information obtained from the Utah State Treasurer's Office). In accordance with the requirements of UAC R315-309, San Juan County maintains its fund contribution schedule to ensure that the full amount of financial assurance is available at the end of each 5-year permit life.

Assuming an annual return on investment on the low end of the reported range (2.0 percent) for the PTIF and no inflation, San Juan County, without any payments into the fund, will have more than \$600,000 in its PTIF before the end of the 5-year permit life, more than enough to cover the revised Closure and Post-Closure cost estimates. Return on investment and inflation will be reviewed on an annual basis and annual fund contributions will be adjusted accordingly. Due to San Juan County's financial schedule, the first payment to this fund under the renewed 5-year permit will be deposited prior to the end of February 2006. Each subsequent annual payment will be deposited by the end of February for any given year. PTIF account statements will be included with each annual report.

Fund withdrawals are not anticipated prior to the initiation of Cell 1 closure activities in approximately 5 years. At that time, San Juan County will re-assess future cell closure plans and projected costs and make the appropriate adjustments to the financial assurance mechanism.

## 8.0 REFERENCES

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Vector Engineering, Inc., 1997, Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill, San Juan County, Utah: unpublished report prepared for San Juan County and submitted to the Utah Department of Environmental Quality, December 1997.

**APPENDIX A**  
**Reduced Drawing Set**

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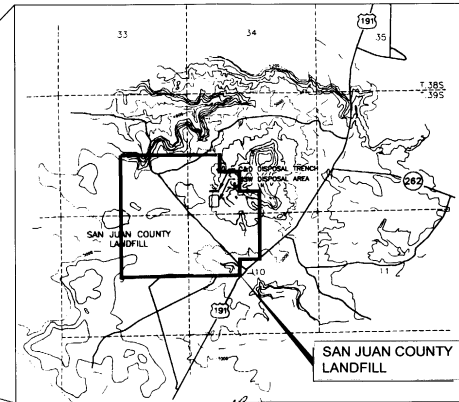
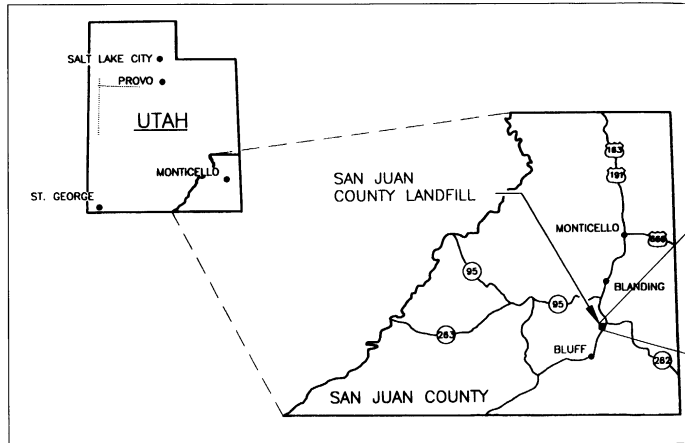
Application for Renewal  
San Juan County Landfill



# ENGINEERING REPORT SAN JUAN COUNTY

## CLASS I MUNICIPAL SOLID WASTE DISPOSAL FACILITY

### SAN JUAN COUNTY LANDFILL SAN JUAN COUNTY, UTAH

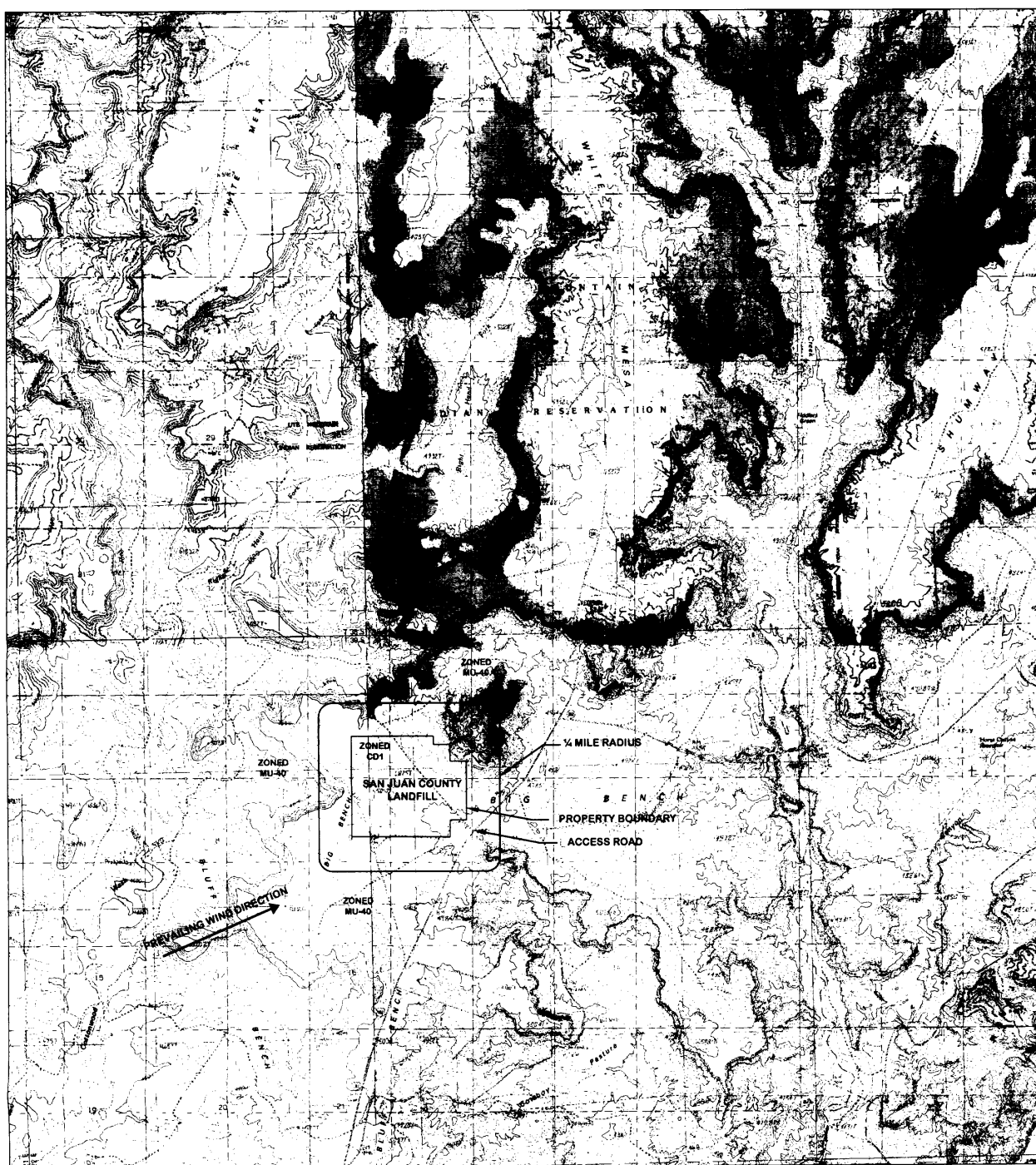


#### LIST OF DRAWINGS

SHEET	DWG. NO.	DRAWING TITLE
1 OF 9	106801-201	TITLE SHEET AND GENERAL PROJECT LOCATION MAP
2 OF 9	106801-202	U.S.G.S. 7.5 MINUTE QUADRANGLE MAP (1989)
3 OF 9	106801-203	EXISTING TOPOGRAPHY AND FACILITIES
4 OF 9	106801-204	1998 AND 2004 TOPOGRAPHY
5 OF 9	106801-205	FINAL GRADING PLAN
6 OF 9	106801-206	FILL SEQUENCING PLAN
7 OF 9	106801-207	CROSS-SECTIONS
8 OF 9	106801-208	DETAILS
9 OF 9	106801-209	HYDROLOGIC SUB-AREA LAYOUT

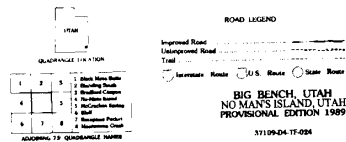
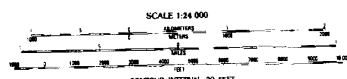


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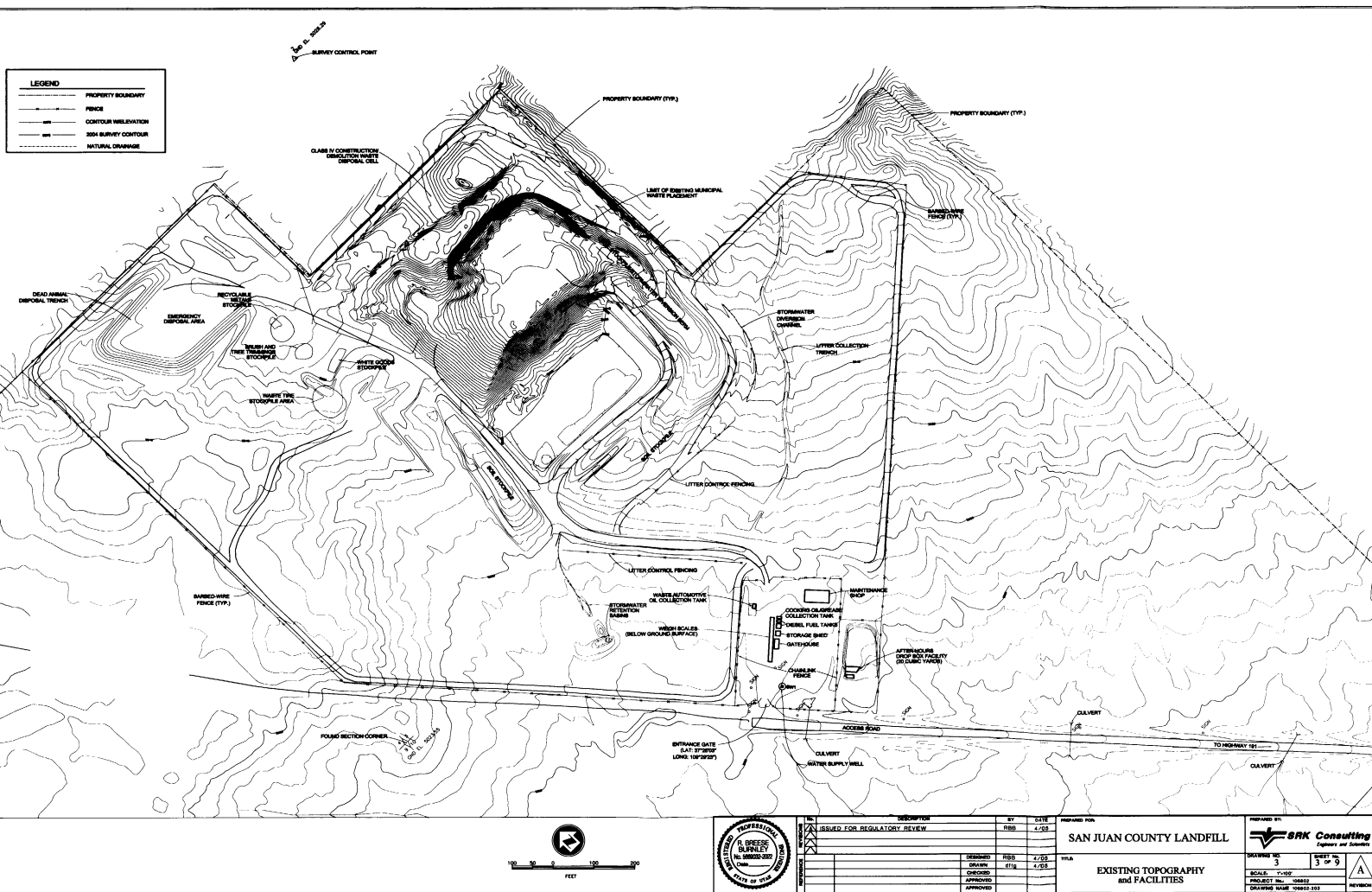
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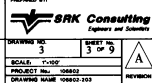
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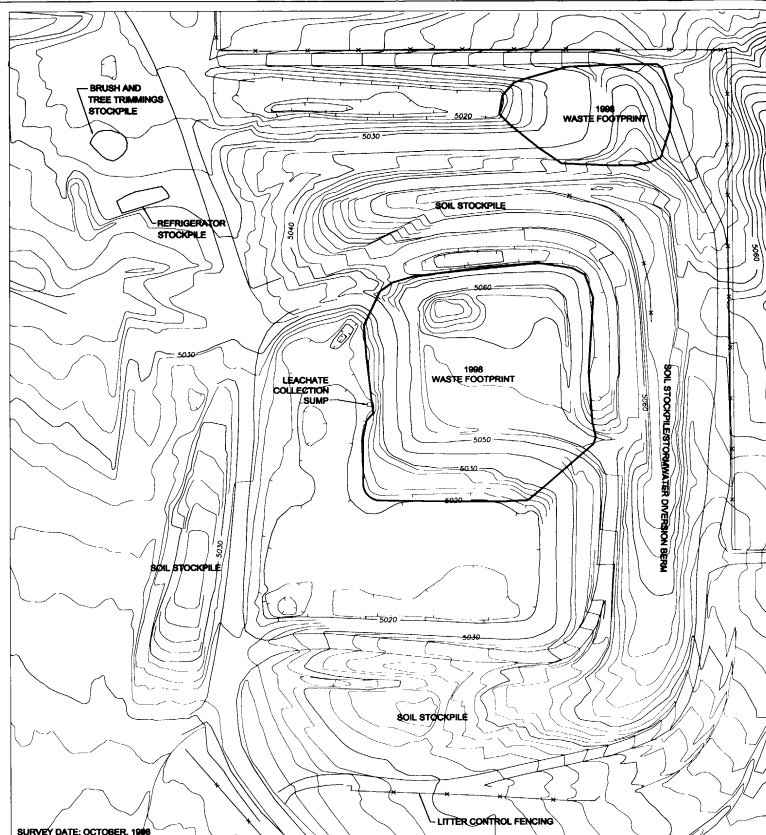


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SAN JUAN COUNTY LANDFILL

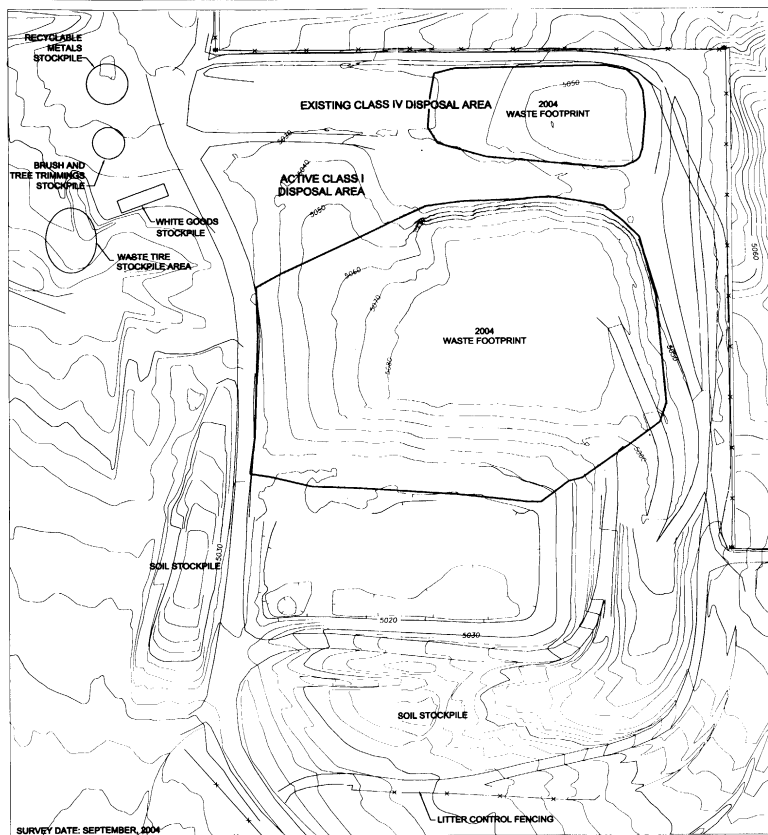
### EXISTING TOPOGRAPHY and FACILITIES





SURVEY DATE: OCTOBER, 1998

1998 TOPOGRAPHY  
1"=60'



SURVEY DATE: SEPTEMBER, 2004

2004 TOPOGRAPHY  
(AREA SURVEYED IN 2004  
SHOWN IN BROWN)  
1"=60'



NO.	DESCRIPTION	BY	DATE	PREPARED FOR
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2	DESIGNED	RBB	2/08	
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SAN JUAN COUNTY LANDFILL

1998 AND 2004 TOPOGRAPHY

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1	ISSUED FOR REGULATORY REVIEW	RBB	4/08	SAN JUAN COUNTY LANDFILL
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5	APPROVED	RBB	4/08	
6	APPROVED			

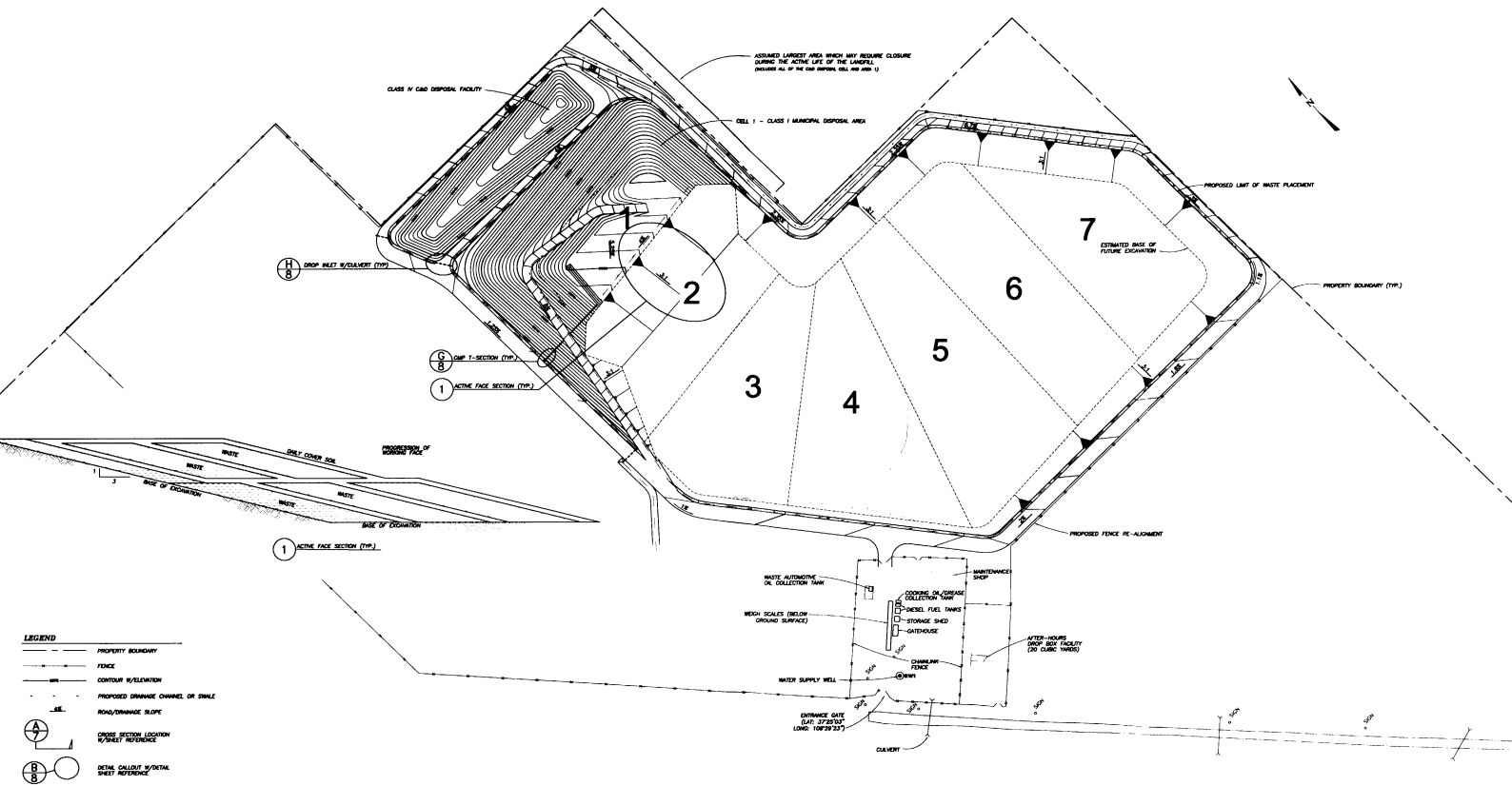
SAN JUAN COUNTY LANDFILL

1998 AND 2004 TOPOGRAPHY

NO.	DESCRIPTION	BY	DATE	PREPARED FOR
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2	DESIGNED	RBB	2/08	
3	DRAWN	RBB	4/08	
4	CHECKED	RBB	4/08	
5	APPROVED	RBB	4/08	
6	APPROVED			

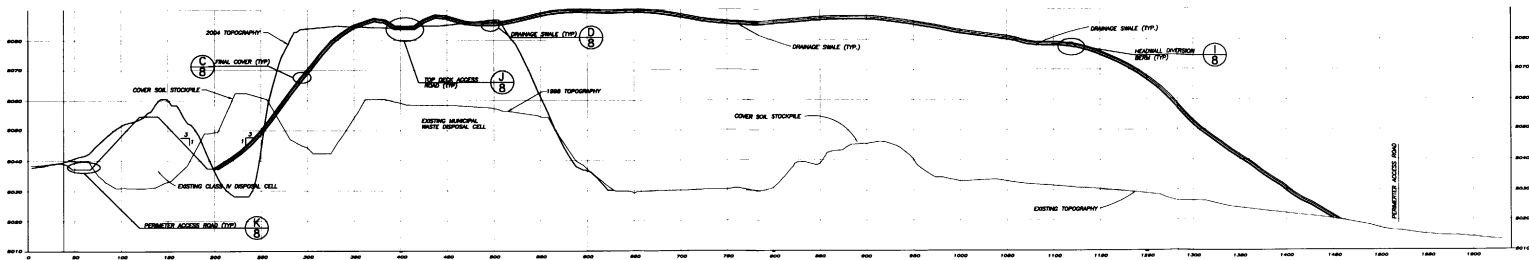
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2	DESIGNED	RBB	2/08	
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5	APPROVED	RBB	4/08	
6	APPROVED			



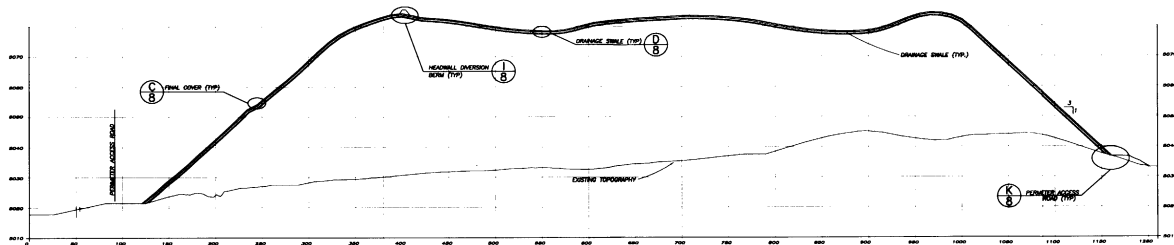


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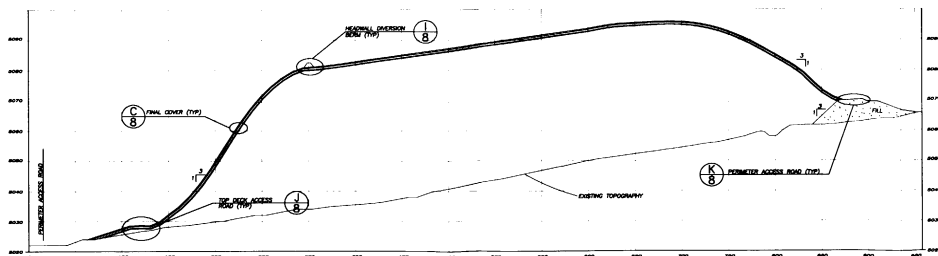
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DRAWING NAME: 100000000-208		SHEET NO.: 6 OF 8	
SCALE: 1" = 100'		REVISION:	



LANDFILL CROSS SECTION A  
HORIZ 1"=50' VERT 1"=15'



LANDFILL CROSS SECTION B  
HORIZ 1"=50' VERT 1"=15'

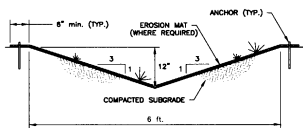


LANDFILL CROSS SECTION C  
HORIZ 1"=50' VERT 1"=15'

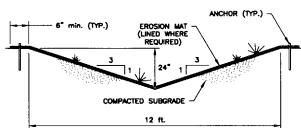


NO.	DESCRIPTION	BY	DATE
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2	DESIGNED	RHB	4/05
3	CHECKED	STB	4/05
4	APPROVED		

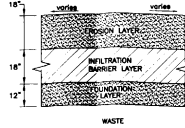
PREPARED FOR <b>SAN JUAN COUNTY LANDFILL</b>		PREPARED BY <b>SRK Consulting</b> <i>(Engineers and Geologists)</i>
DRAWING NO. <b>7</b>	SHEET NO. <b>7 OF 9</b>	SCALE: AS SHOWN PROJECT NO.: 10080 DRAWING DATE: 10/05/05
CROSS-SECTIONS		
REVISION		



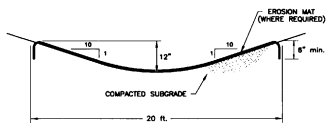
GRASS LINED V-DITCH (A)  
N.T.S. 5.9



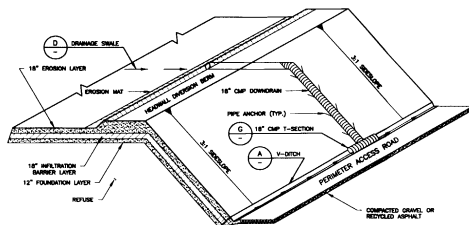
DIVERSION CHANNEL (B)  
N.T.S. 5.9



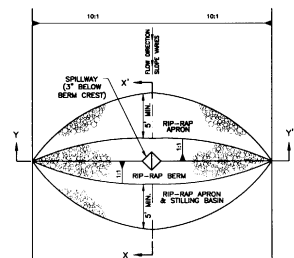
FINAL COVER DESIGN (C)  
REVISED JANUARY 2000 N.T.S. 5.8



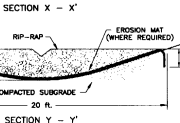
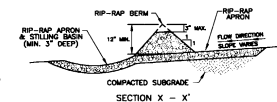
DRAINAGE SWALE (D)  
N.T.S. 5.9



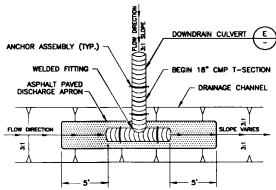
DOWNDRAIN CULVERT - ISOMETRIC VIEW (E)  
N.T.S. 5.9



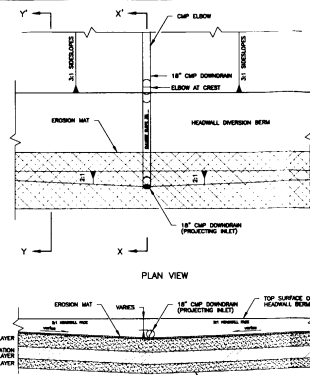
RIP-RAP FLOW CONTROL BERM (TYP.) (F)  
(WITHIN TOP DECK SWALES) N.T.S. 5.9



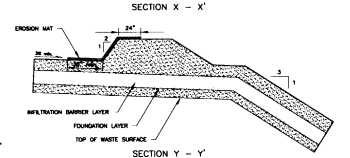
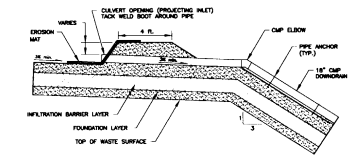
DROP INLET W/CULVERT (H)  
N.T.S. 5.9



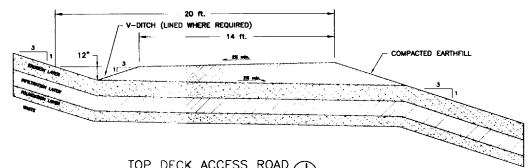
CMP T-SECTION (I)  
N.T.S. 5.9



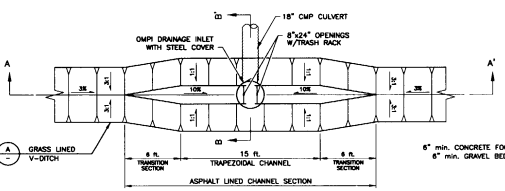
HEADWALL DIVERSION BERM (J)  
N.T.S. 5.9



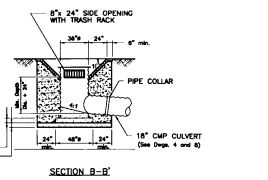
HEADWALL CROSS SECTIONS



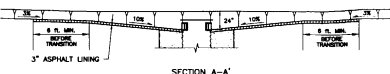
TOP DECK ACCESS ROAD (M)  
N.T.S. 5.9



DROP INLET W/CULVERT (N)  
N.T.S. 5.9



SECTION B-B'



SECTION A-A'

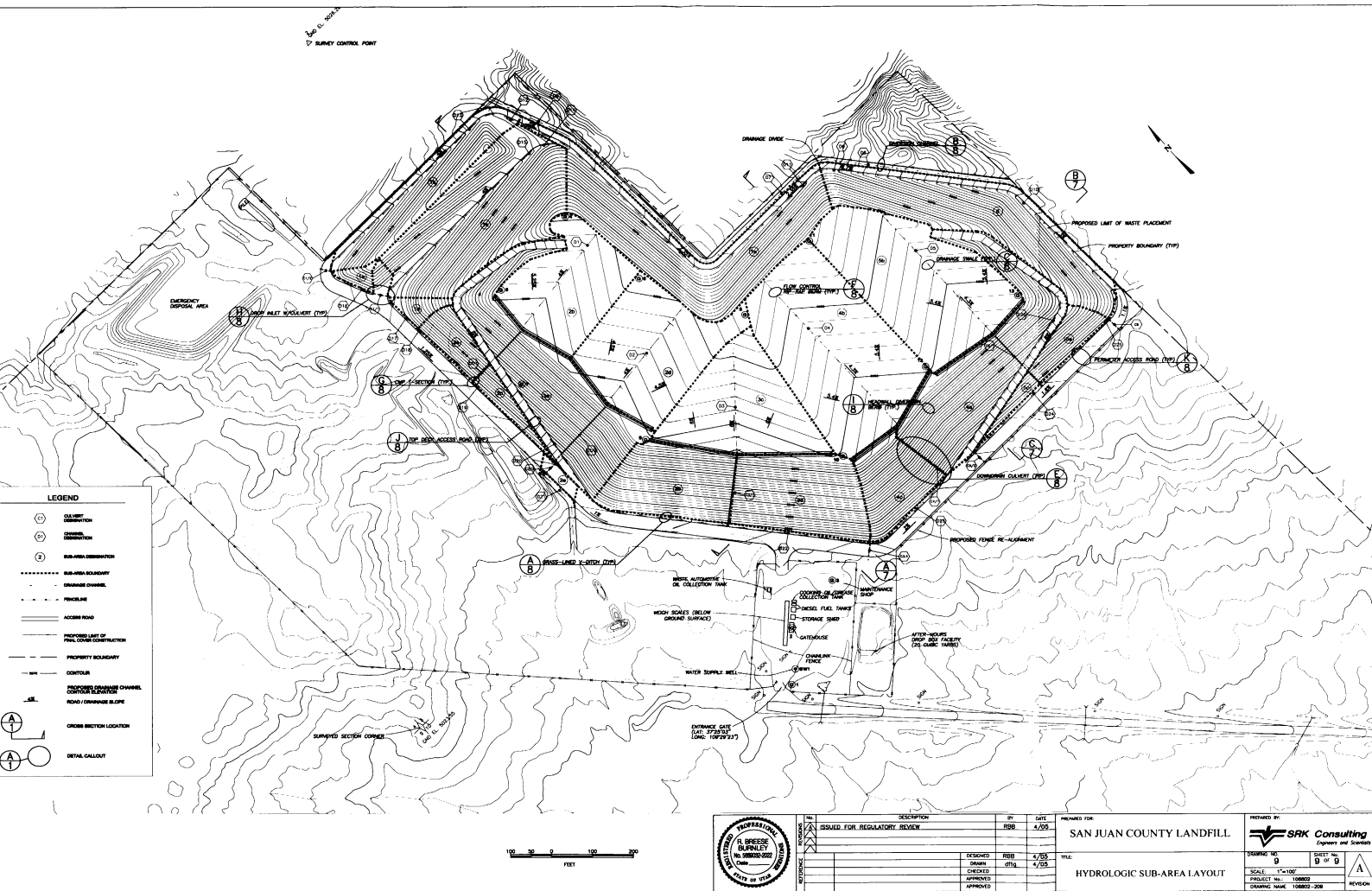


NO.	DESCRIPTION	BY	DATE	PREPARED FOR
1	ISSUED FOR REGULATORY REVIEW	RBH	4/05	SAN JUAN COUNTY LANDFILL
DESIGNED	RBH	4/05		
DRAWN	RTB	4/05		
CHECKED		4/05		
APPROVED				

PREPARED BY: **SRK Consulting**  
 ENGINEERS AND SURVEYORS  
 DRAWN TO: **8" x 11"**  
 SCALE: **AS SHOWN**  
 PROJECT NO.: **000000**  
 DRAWING NAME: **SHARD 200**

DETAILS





**APPENDIX B**

**Solid Waste Landfill Permit 95-03 and Subsequent Modifications**

Application for Renewal  
San Juan County Landfill



DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF SOLID AND HAZARDOUS WASTE

Michael O. Leavitt  
Governor  
Dianne R. Nielson, Ph.D.  
Executive Director  
Dennis R. Downs  
Director

288 North 1460 West  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880  
(801) 538-6170  
(801) 538-6715 Fax  
(801) 536-4414 T.D.D.  
[www.deq.state.ut.us](http://www.deq.state.ut.us) Web

August 10, 2000

San Juan Record  
P.O. Box 879  
Monticello, UT 84535

Dear Sir/Madam:

This letter constitutes authorization to publish the attached NOTICE in the *San Juan Record* on Wednesday, August 16, 2000.

Please send invoice and affidavit of publication to:

Dennis R. Downs, Director  
Division of Solid and Hazardous Waste  
Utah Department of Environmental Quality  
PO Box 144880  
Salt Lake City, Utah 84114 - 4880

RECEIVED  
AUG 30 2000  
MONTICELLO, UT

Sincerely,

A handwritten signature in cursive script, reading "Jeff Emmons", is written over the word "Sincerely,".

Jeff Emmons, Environmental Scientist  
Solid Waste Section

JE/kg

Enclosure

c: David Cunningham, B.S.N., R.N., Dir., Southeastern Utah Dist. Health Dept.  
David Ariotti, DEQ District Engineer  
Rick Meyer, Southeastern Utah Dist. Health Dept.  
Rick Bailey, San Juan County



DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF SOLID AND HAZARDOUS WASTE

Michael O. Leavitt  
Governor  
Dianne R. Nielson, Ph.D.  
Executive Director  
Dennis R. Downs  
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Salt Lake City, Utah 84114-4880  
(801) 538-6170  
(801) 538-6715 Fax  
(801) 536-4414 T.D.D.  
[www.deq.state.ut.us](http://www.deq.state.ut.us) Web

August 10, 2000

Newspaper Agency Corporation  
Legal Advertising Department  
Front Counter  
143 South Main Street  
Salt Lake City, Utah 84101

Dear Sir/Madam:

This letter constitutes authorization to publish the attached NOTICE in the *Salt Lake Tribune* and the *Deseret News* on Wednesday, August 16, 2000.

Please send invoice and affidavit of publication to:

Dennis R. Downs, Director  
Division of Solid and Hazardous Waste  
Utah Department of Environmental Quality  
PO Box 144880  
Salt Lake City, Utah 84114 - 4880

Sincerely,

A handwritten signature in cursive script, appearing to read "Jeff Emmons".

Jeff Emmons, Environmental Scientist  
Solid Waste Section

JE/kg

Enclosure

c: David Cunningham, B.S.N., R.N., Health Off/Dept Dir, Southeast Utah Dist Health Dept  
David Ariotti, DEQ District Engineer  
Rick Meyer, Southeastern Utah Dist Health Dept.  
Rick Bailey, San Juan County

## NOTICE

San Juan County submitted a permit renewal application, to the Utah Division of Solid and Hazardous Waste, for its Class I landfill located approximately 11 miles south of Blanding, Utah. The Division reviewed the application and determined it to be complete. The application and a draft landfill permit were released for public comment. The 30-day public comment period was announced in the *San Juan Record*, *Salt Lake Tribune*, and *Deseret News* on June 28, 2000. No comments were received and permit renewal was granted on August 1, 2000.



DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF SOLID AND HAZARDOUS WASTE

Michael O. Leavitt  
Governor

Dianne R. Nielson, Ph.D.  
Executive Director

Dennis R. Downs  
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(801) 538-6715 Fax  
(801) 536-4414 T.D.D.  
[www.deq.state.ut.us](http://www.deq.state.ut.us) Web

August 10, 2000

Rick Bailey  
Administrative Assistant  
San Juan County Commission  
P.O. Box 9  
Monticello, Utah 84535

Subject: Permit for the San Juan County Landfill Class I Landfill

Dear Mr. Bailey:

The 30-day public comment period for the draft landfill permit and the permit application began on June 28, 2000 and ended July 28, 2000. The announcement of the public comment period appeared in the *San Juan Record*, *Salt Lake Tribune*, and *Deseret News*. No comments were received during the public comment period. Accordingly, no changes were required to the draft permit.

Enclosed is Permit #9305R to operate the San Juan County Class I Landfill. The Permit expires on July 31, 2005. If renewal of the permit is desired, San Juan County must apply for renewal of the permit 180 days prior to the expiration date. A public notice of the permit issuance, will appear on August 16, 2000 in same newspapers as mentioned above.

Periodic inspections of the landfill will be conducted by personnel from the Division of Solid and Hazardous Waste and/or the Southeast Utah District Health Department. The landfill inspections are to assess compliance with the conditions of the Permit and the *Solid Waste Permitting and Management Rules*.

I appreciate the responsiveness and thoroughness of San Juan County during the permitting process. Please give me a call at 801-538-6748 if you have any questions.

Sincerely,

A handwritten signature in black ink that reads "Jeff Emmons".

Jeff Emmons  
Utah Solid and Hazardous Waste

JE/kg

enclosure

Breese Burnley, SRK Consulting Engineers and Scientist  
David Ariotti, DEQ District Engineer  
David Cunningham, B.S.N., R.N., Health Off/Dept Dir, Southeast Utah Dist Health Dept.  
Rick Meyer, Southeastern Utah District Health Department

**UTAH SOLID AND HAZARDOUS WASTE CONTROL BOARD  
SOLID WASTE PERMIT**

**CLASS I LANDFILL**

Pursuant to the provisions of the *Utah Solid and Hazardous Waste Act*, Title 19, Chapter 6, Utah Code Annotated (UCA) 1953, as amended (the Act) and the *Utah Solid Waste Permitting and Management Rules*, Utah Administrative Code (UAC) R315-301 through 320 adopted thereunder,

**San Juan County**

is hereby authorized to operate the San Juan County Landfill located in portions of Sections 3, 4, 9, and 10, Township 39 South, Range 22 East, Salt Lake Base and Meridian, San Juan County, Utah as shown in the permit application dated June 1999 and amended January 2000.

The operation of the landfill is subject to the condition that San Juan County (Permittee) meet the requirements set forth herein.

All references to UAC R315-301 through 320 are to regulations that are in effect on the date that this permit becomes effective. If changes are made in UAC R315-301 through 320 that affect the operation or activities at the landfill, the changes shall become effective on the landfill 180 days following the effective date of the rule or upon a compliance schedule as established for the landfill by the Executive Secretary.

This permit shall become effective August 1, 2000.

This permit shall expire at midnight July 31, 2005.

Signed this 1st day of August, 2000.



Dennis R. Downs, Executive Secretary  
Utah Solid and Hazardous Waste Control Board

## PERMIT REQUIREMENTS

NAME: San Juan Class I Landfill

ADDRESS: San Juan County  
117 South Main Street  
Monticello, Utah 84535  
Phone: 435-587-3225

TYPE OF PERMIT: Class I Landfill

PERMIT NUMBER: 9305R

LOCATION: Landfill site is located in Township 39 South, Range 22 East, partial Sections 3,4,9, and 10, SLMB; San Juan County, Lat. 37° 25' 30", Long. 109° 28' 30"

Permit as used in this document is defined in Utah Administrative Code (UAC) R315-301-2(54).

The application as deemed complete on May 3, 2000, is hereby approved and is incorporated by reference into this Solid Waste Permit. All representations made in the permit application are part of this permit and are enforceable under UAC 315-301-5(2). The permit application will become part of the operating record of the Landfill. Where differences in wording exist between this permit and the application, the wording of the permit supersedes that of the application.

By this permit to operate, the Permittee is subject to the following conditions.

### I. GENERAL COMPLIANCE RESPONSIBILITIES

#### A. General Operation

The Permittee shall operate the municipal landfill in accordance with all applicable requirements of UAC R315-302 and 303, for a Class I landfill, that are currently effective unless otherwise noted in this permit. Any permit noncompliance or other noncompliance constitutes a violation of UAC R315-302 or 303 and is grounds for appropriate enforcement action, permit termination, modification, or denial of a permit renewal application.



B. Acceptable Waste

This permit is for the disposal of nonhazardous solid waste which may include, municipal solid waste, commercial waste, industrial waste, construction/demolition waste, and special waste.

C. Prohibited Waste

No hazardous waste as defined by UAC R315-1 and R315-2, except waste specified by UAC R315-303-4(7)(a)(i)(B); or PCB's as defined by UAC R315-301(52), except those specified by UAC R315-315-7(2), may be accepted for treatment, storage, or disposal at the landfill. Any prohibited waste received and accepted for treatment, storage, or disposal at the facility will constitute a violation of this permit and UAC R315-303-4(7).

D. Inspections and Inspection Access

The Permittee shall allow the Executive Secretary of the Utah Solid and Hazardous Waste Control Board or an authorized representative, including representatives from the Southeastern Utah District Health Department, to enter at reasonable times and:

1. Inspect the landfill or other premises, practices or operations regulated or required under the terms and conditions of this Permit or UAC R315-301 through 320;
2. Have access to and copy any records required to be kept under the terms and conditions of the Permit or UAC R315-301 through 320;
3. Inspect any loads of waste, treatment, pollution management, or control facilities required under the Permit or regulated under UAC R315-301 through 320; and
4. Obtain a record of any inspection by photographic, videotape, electronic, or other reasonable means.

E. Noncompliance

1. If monitoring, inspection, or testing indicates that any permit condition or any applicable rule under UAC R315-301 through 320 may be or is being violated, the Permittee shall promptly make corrections to the operation or other activities to bring the facility into compliance with all permit conditions or rules. In the event of any noncompliance with any permit

condition or violation of an applicable rule, the Permittee shall promptly take any feasible action reasonably necessary to correct the noncompliance or violation and mitigate any risk to the human health or the environment. Actions may include eliminating the activity causing the noncompliance or violation and containment of any waste or contamination using barriers or access restrictions, placing of warning signs, or permanently closing areas of the facility. The Permittee shall: document the noncompliance or violation in the operating record; notify the Executive Secretary of the Solid and Hazardous Waste Control Board within 24 hours, or the next business day following the event; and give written notice of the noncompliance or violation and measures taken to protect public health and the environment within seven days. Within thirty days of the occurrence of the event, the Permittee shall submit, to the Executive Secretary, a written report describing the nature and extent of the noncompliance or violation and the remedial measures taken or to be taken to protect human health and the environment and to eliminate the noncompliance or violation. Upon receipt and review of the assessment report, the Executive Secretary may order the Permittee to perform appropriate remedial measures including development of a site remediation plan for approval by the Executive Secretary.

2. It shall not constitute a defense for the Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.
3. Compliance with the terms of this permit does not constitute a defense to actions brought under any other local, State, or Federal laws. This permit does not exempt the Permittee from obtaining any other local, State or Federal permits or approvals.
4. The issuance of this Permit does not convey any property rights, other than the rights inherent in this permit, in either real or personal property, or any exclusive privileges nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations including zoning ordinances.
5. The provisions of this Permit are severable. If any provision of this Permit shall be held invalid for any reason, the remaining provisions shall remain in full force and effect. If the application of any provision of this Permit to any circumstance is held invalid, its application to other circumstances shall not be affected.

F. Revocation

1. This permit is subject to revocation if any condition of the permit is not being met. The Permittee will be notified in writing prior to any proposed revocation action and such action will be subject to all applicable hearing procedures established under UAC R315-12 and the *Utah Administrative Procedures Act*.
2. Revocation of this permit does not revoke the financial assurance established for closure and post-closure care of the facility, nor remove any responsibility for completion of closure and post-closure care for the facility required in UAC R315-302-3.

G. Application Revision

The application and changes made in the responses to Notices of Deficiency shall be organized into a single, comprehensive reference document and submitted to the Executive Secretary no later than 90 days from the effective date of this permit.

II. DESIGN AND CONSTRUCTION

A. Design and Construction

1. The Permittee shall construct the landfill cells, run-on and run-off diversion systems, and the final cover in accordance with the plans presented in the permit application and the Utah Solid Waste Permitting and Management Rules (UAC R315-301 thru 320). If ground water is encountered during excavation of the landfill, the Executive Secretary shall be notified immediately, and a contingency plan implemented or alternative construction design developed and submitted for approval.
2. The permittee shall notify the Executive Secretary upon completion of construction of any landfill cells or run-on and run-off diversion systems. No landfill cells or run-on and run-off diversion system may be used until construction is approved by the Executive Secretary.
3. The permittee shall notify the Executive Secretary of the completion of construction of any final cover system and shall receive approval of the construction by the Executive Secretary.

B. Run-On Control

Drainage channels and diversions shall be constructed as specified in the permit application and maintained at all times to effectively prevent runoff from the surrounding area from entering the landfill.

C. Quality Assurance Construction Plan

1. A quality assurance plan for construction of the final landfill cover shall be submitted by the Permittee and approved by the Executive Secretary prior to construction of any part of the liner system or final cover at the landfill.
2. A qualified third party shall perform permeability testing on the clay liner and compacted clay layer of the final cover, and other testing as required by the approved Quality Assurance Plan. The results must be submitted as part on the as-built drawings to the Executive Secretary.

III. LANDFILL OPERATION

A. Operations Plan

The Operations Plan included in the permit application shall be kept on-site at the landfill. The landfill shall be operated in accordance with the operations plan as included in the permit application.

B. Security

The Permittee shall operate the Landfill in a manner such that unauthorized entry to the facility is prevented. The front gate shall be locked during the time the landfill is not open. At least one on site persons, employed by the San Juan County, shall be at the landfill during all hours that the landfill is open. Fencing and/or any other access controls as shown in the permit application shall be constructed to prevent access of persons or livestock by other routes.

C. Training

Permittee shall provide training for on-site supervisors in landfill operation, including waste load inspection, hazardous waste identification, and personal safety and protection.

D. Burning of Waste

Intentional burning of solid waste is prohibited and is a violation of UAC R315-303-4(2)(b). Burning of material when meeting the requirements of UAC R307-202-5 is allowed in a segregated area within the landfill site. All accidental fires shall be extinguished as soon as reasonably possible.

E. Daily Cover

The solid waste received at the landfill shall be completely covered at the end of each working day with a minimum of six inches of earthen material. Alternative cover material may be used if approved by the Executive Secretary. List any alternative daily covers approved.

F. Ground Water Monitoring

This facility has demonstrated through geologic, hydrogeologic, climatic and other factors that the landfill will not contaminate ground water and is approved for the alternative design as outlined in the permit application. Any contamination of ground water resulting from operation of the landfill will result in the revocation of this alternative design approval.

G. Gas Monitoring

The Permittee shall monitor explosive gases at the landfill in accordance with the Gas Monitoring Plan contained in the permit application and shall otherwise meet the requirements of UAC R315-303-3(5).

If the concentrations of explosive gases at any of the facility structures, at the property boundary or beyond, ever exceed the standards set in UAC R315-303-2(2)(a), the Permittee shall immediately take all necessary steps to ensure protection of human health and notify the Executive Secretary. Within seven days of detection, place in the operating record the explosive gas levels detected and a description of the immediate steps taken to protect human health. Implementation of a remediation plan shall meet the requirements as stated in UAC R315-303-3(5)(b) and shall be submitted and approved by the Executive Secretary prior to implementation.

H. Waste Inspections

The permittee shall visually inspect incoming waste loads to verify that no wastes other than those allowed by this permit are disposed in the landfill. At the

frequency defined in the permit application, the Permittee shall conduct a complete waste inspection.

I. Disposal of Liquids

Disposal of containers of liquids larger than household size (five gallons), noncontainerized material containing free liquids, sludge containing free liquids, or any waste containing free liquids in containers larger than five gallons is prohibited.

J. Disposal of Special Wastes

Animal carcasses may be disposed at the bottom of the landfill working face and must be covered with other solid waste or earth by the end of the working day they are received or they may be disposed in a special trench or pit prepared for the acceptance of dead animals. If a special trench is used, animals placed in the trench shall be covered with a minimum of six inches of earth by the end of each working day.

Asbestos waste shall be handled and disposed in accordance with UAC-315-315-2.

Ash shall be transported in such a manner to prevent leakage or the release of fugitive dust. The ash shall be completely covered with a minimum of six inches of material, or use other methods or material, if necessary, to control fugitive dust. Ash may be used for daily cover when its use does not create human health and environmental hazard.

K. Self Inspections

The Permittee shall inspect the facility to prevent malfunctions and deterioration, operator errors, and discharges which may cause or lead to the release of wastes or contaminated materials to the environment or create a threat to human health.

These general inspections shall be completed no less than quarterly. A record of the inspections shall be maintained in the operating record.

L. Recordkeeping

The Permittee shall maintain and keep on file at the landfill office, an operating record as required by UAC R315-302-2(3). The operating record shall include the following items:

1. A copy of the permit including the permit application;

2. The number of loads of waste and the weights or estimates of weights of waste received each day of operation;
3. Major deviations from the approved plan of operation;
4. Results of other monitoring required by this permit;
5. Records of employee training;
6. Records of all inspections conducted by the Permittee;
7. Results of inspections conducted by representatives of the Utah Solid and Hazardous Waste Control Board and representatives of the Southeastern District Health Department, when forwarded to the permittee; and
8. Closure and Post-closure care plans.
9. Results of landfill gas monitoring;

M. Reporting

The Permittee shall prepare and submit an Annual Report to the Executive Secretary as required in UAC R315-302-2(4). The Annual Report shall include: period covered by the report, annual quantity of waste received, estimated in-place density of waste, annual update of the financial assurance mechanism, results of gas monitoring, and training programs completed.

N. Roads

All access roads, within the landfill boundary, used for transporting waste to the landfill for disposal shall be improved and maintained as necessary to assure safe and reliable all-weather access to the disposal area.

#### IV. CLOSURE REQUIREMENTS

A. Closure

Final cover of the landfill shall be as shown in the permit application. The final cover shall meet at a minimum the standard design for closure as specified in the UAC (R315-303-3(4)) plus sufficient cover soil or equivalent material to protect the low permeability layer from the effects of frost, desiccation, and root penetration. A quality assurance plan for construction of the final landfill cover

shall be submitted by the Permittee and approved by the Executive Secretary prior to construction of any part of the final cover at the landfill. A qualified third party shall perform permeability testing on the recompacted clay placed as part of the final cover. The Permittee shall also meet the requirements of UAC R315-302-2(6) by recording with the San Juan County Recorder as part of the record of title that the property has been used as a landfill.

B. Post-Closure Care

The post-closure care at the closed landfill shall be done in accordance with the Post-Closure Care Plan contained in the permit application for a period of 30 years or until the Executive Secretary finds that the closed landfill has become stabilized and the conditions of UAC R315-302-3(7)(b) or (c) have been met.

C. Financial Assurance

1. A financial assurance mechanism covering closure and post-closure care costs shall be proposed by the Permittee and approved by the Executive Secretary. The approved mechanism shall be established by the Permittee prior to receipt of waste. An annual revision of closure costs and financial assurance funding shall be submitted to the Executive Secretary as part of the annual report. The financial assurance fund shall be adequately funded to provide for the cost of closure at any stage or phase or anytime during the life of the landfill and must be fully funded within five years from the effective date of this permit applications.
2. The permittee shall notify the Executive Secretary of the establishment of the approved financial assurance mechanism and must receive acknowledgment from the Executive Secretary that the established mechanism complies with the approved method.

V. ADMINISTRATIVE REQUIREMENTS

A. Permit Modification

Modifications to this permit may be made upon application by the Permittee or by the Executive Secretary. The Permittee will be given written notice of any permit modification initiated by the Executive Secretary.



B. Permit Transfer

This permit may be transferred to a new Permittee by meeting the requirements of the permit transfer provisions of UAC R315-310-9.

C. Expansion

1. This permit is for the operation of a Class I Landfill according to the design and Operation Plan described and explained in the permit application. Any expansion of the current footprint designated in the description contained in the permit application will require submittal of plans and specifications to the Executive Secretary. The plans and specifications must be approved by the Executive Secretary prior to construction.
2. Any expansion of the landfill facility beyond the property boundaries designated in the description contained in the permit application will require submittal of a new permit application in accordance with the requirements of UAC R315-310.

D. Expiration

This permit shall expire five years from the effective date which is the date shown on the signature (first) page of this permit. Application for permit renewal shall be made at least 180 days prior to the expiration of this permit. If a timely renewal application is made and the permit renewal is not complete by the expiration date, this permit will continue in force until renewal is completed or denied.

E. Status Notification

Eighteen months from the date of this permit the Executive Secretary shall be notified in writing of the status of the construction of this facility unless construction is complete and operation has commenced. If construction has not begun within 18 months the Permittee will submit adequate justification to the Executive Secretary as to the reasons that construction has not commenced. If no submission is made or the submission is judged inadequate by the Executive Secretary, this permit will be revoked

B. Permit Transfer

This permit may be transferred to a new Permittee by meeting the requirements of the permit transfer provisions of UAC R315-310-9.

C. Expansion

1. This permit is for the operation of a Class I Landfill according to the design and Operation Plan described and explained in the permit application. Any expansion of the current footprint designated in the description contained in the permit application will require submittal of plans and specifications to the Executive Secretary. The plans and specifications must be approved by the Executive Secretary prior to construction.
2. Any expansion of the landfill facility beyond the property boundaries designated in the description contained in the permit application will require submittal of a new permit application in accordance with the requirements of UAC R315-310.

D. Expiration

This permit shall expire five years from the effective date which is the date shown on the signature (first) page of this permit. Application for permit renewal shall be made at least 180 days prior to the expiration of this permit. If a timely renewal application is made and the permit renewal is not complete by the expiration date, this permit will continue in force until renewal is completed or denied.

E. Status Notification

Eighteen months from the date of this permit the Executive Secretary shall be notified in writing of the status of the construction of this facility unless construction is complete and operation has commenced. If construction has not begun within 18 months the Permittee will submit adequate justification to the Executive Secretary as to the reasons that construction has not commenced. If no submission is made or the submission is judged inadequate by the Executive Secretary, this permit will be revoked

F:\SHW\SPBJEMMONS\WP\SANJUAN\Permit2000 Permit.wpd  
File: San Juan County / San Juan County Landfill- Permit #9305R



State of Utah  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF SOLID AND HAZARDOUS WASTE

Michael O. Leavitt  
Governor  
Dianna R. Nielson, Ph.D.  
Deputy Governor  
Dennis R. Downs  
Director  
288 North 1460 West  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880  
(801) 538-6170  
(801) 538-5715 Fax  
(801) 536-4414 T.D.D.

February 17, 1994

Mr. Bill Reed  
San Juan County Commissioner  
P.O. Box 9  
Monticello, Utah 84535

Dear Mr. Reed:

Enclosed in the solid waste plan approval (Permit) to operate the White Mesa Sanitary Landfill. The permit expires five years from the date of signature. San Juan County must apply for renewal of the permit, if renewal is desired, six months before the expiration date.

Please contact Wade Hansen or Ralph Bohn at (801) 538-6170 if you have any questions regarding the permitting process.

Sincerely yours,

Dennis R. Downs, Director  
Division of Solid and Hazardous Waste

DRD/WH/wh

Enclosure

c: Gary Angott, M.S.P.H., Director, Southeastern Utah District Health Department  
Dave Ariotti, District Engineer  
Brian Bremner, Garfield County Engineer  
Julie Orr, NAIHS Agent

**WHITE MESA SANITARY LANDFILL  
SOLID WASTE PERMIT FACT SHEET**

Facility name: White Mesa Sanitary Landfill

Location: Southeastern San Juan County, approximately 15 miles south of Blanding, Utah.

Facility Contact: Bill Reed  
San Juan County Commissioner

Type of Facility: Municipal Sanitary Landfill

Description:

Six hundred forty acres are being acquired by San Juan County from the Bureau of Land Management to develop a sanitary landfill to meet the needs of the San Juan County area. The site is centrally located in an effort to accommodate regionlization. The site is relatively isolated, and has positive characteristics when considering topography, precipitation, and depth to groundwater. The location complies with siting criteria currently mandated by Subtitle D of the federal regulations. The landfill will implement a liner design consisting of 36 inches of compacted earthen material meeting specific low permeability requirements. Initial operation will be limited to a cell 40 feet deep with an estimated two year life. Waste handled by the White Mesa Sanitary Landfill will be comprised of municipal household, commercial, and industrial waste, generated in the service area. Special wastes such as dead animals, nonhazardous sludge, bulky wastes (car bodies, appliances, furniture) etc., will be accepted only after proper handling provisions have been made. No regulated quantity of hazardous waste will be accepted for treatment, storage, or disposal at the landfill. Material designated for disposal will be dumped, spread, and compacted at the cell working face. By the end of each day's operation, waste will be covered with 6 inches of earthen material. Closure operations will be performed on an ongoing basis when a portion of a cell attains final elevation and sufficient area exists to place final cover. Final cover will consist of 24 inches of material, having a permeability equal to or less than that of the bottom liner topped with 6 inches of native soil. Areas that have received final cover will be contoured, seeded with native species, and landscaped to blend in with local terrain.

A draft permit was issued to San Juan County and a copy provided to the Southeastern Utah District Health Department on November 5, 1993. A comment period was held from December 15, 1993 to January 18, 1994. Notice of the comment period was published on December 15, 1993 in Salt Lake Tribune, Deseret News, and San Juan Record. No comments were received at the office of the Division of Solid and Hazardous Waste. A Public Hearing was held at the San Juan County Court House on January 18, 1994. Ty Lewis, San Juan County Commission Chairman, and Brian Bremner, the landfill consulting engineer, were the only members of the public in attendance. No formal comments were received at the hearing.

## UTAH SOLID AND HAZARDOUS WASTE CONTROL BOARD

### SOLID WASTE PLAN APPROVAL (PERMIT)

PERMITTEE NAME: White Mesa Sanitary Landfill

PERMITTEE: San Juan County  
Attn: Bill Reed

ADDRESS: San Juan County Courthouse  
Monticello, Utah 84535  
(801) 477-3375

TYPE OF PERMIT: Class I Solid Waste Landfill

PERMIT #: 93-05

LOCATION: Landfill site is located in T. 39 S., R.  
22 E., Section 10, SLMB;  
San Juan County, Utah

The permit application submitted by San Juan County in March of 1993 and revised June 11, 1993 and July 19, 1993 is incorporated by reference into this solid waste permit. All representations made in the permit application are a part of this permit. Where differences in wording exist between this permit and the application, the permit wording supersedes that of the application.

By this permit to operate, San Juan County (hereafter referred to as Permittee or County) shall be subject to the following conditions:

1. General Operation: The Permittee shall operate the municipal landfill in accordance with all requirements of R315-302 and 303 Utah Administrative Code (UAC) unless otherwise noted in this permit. Any noncompliance with the permit or rules, other than activities authorized by a variance, constitutes a violation of UAC R315 and is grounds for appropriate enforcement action, permit termination, revocation and reissuance, modification, or denial of a permit renewal application.

2. Noncompliance In the event of noncompliance with the permit or rules, the Permittee shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are necessary to protect public health and the environment. Compliance with the terms of this permit does not constitute a defense to actions brought under any other State or Federal law.
3. Inspection All operational procedures as outlined in the permit application shall be followed. The landfill will be subject to inspection by the State and/or the Southeastern Utah District Health Department. A record of the inspection may be made by photographic, videotape, electronic, or other reasonable means.
4. Inspection Access The Permittee shall allow the Executive Secretary of the Utah Solid and Hazardous Waste Control Board, or an authorized representative, including representatives from the Southeastern Utah District Health Department, upon presentation of credentials, to enter during operating hours, and/or inspect at reasonable times any facilities, equipment, practices, or operations regulated or required under this permit.
5. Prohibited Waste No regulated quantity of hazardous waste as defined by R315-1 and R315-2 UAC or PCB's, as defined by R315-301(51), shall be accepted for treatment, storage, or disposal at the landfill. The receipt of such waste at the facility will constitute a violation of this permit and R315-303-5(7).
6. Acceptable Waste This permit is for disposal of municipal and industrial nonhazardous waste from San Juan County only. The landfill operator will inspect all waste loads to verify that no wastes other than municipal and industrial nonhazardous solid waste are disposed in the landfill. Requests for changes in the area from which waste may be accepted shall be submitted to the Executive Secretary for approval.
7. Revocation This permit is subject to revocation if any condition of this permit is not being met. The County will be notified in writing prior to any proposed revocation action and such action will be subject to all applicable hearing procedures established under the Utah Solid and Hazardous Waste Act, R315-319 UAC, and the Utah Administrative Procedures Act.
8. Expiration This permit shall expire five years from the effective date which will be the date the permit is signed by the Executive Secretary of the Utah Solid and Hazardous Waste Control Board. Application for permit renewal shall be made at least six months prior to the expiration of this permit.

9. Expansion Any expansion of the landfill facility beyond the areas designated in the permit application will require submittal of a new permit application in accordance with the requirements outlined in R315-310 UAC. Permittee may not begin construction of any expansion until approval from the Executive Secretary of the Utah Solid and Hazardous Waste Control Board is received in writing.
10. Training Permittee shall provide training for on-site supervisors in landfill operation, including waste load inspection, hazardous waste identification, and personal safety and protection.
11. Design QA/QC A Quality Assurance/Quality Control plan describing methods for procedures to confirm construction as specified in the permit shall be submitted by the County to the Executive Secretary for approval prior to construction.
12. Cover Cover material consisting of at least six inches of dirt or other suitable material as specified in the application shall be applied at the end of each working day. Alternative daily cover material may be used if approved by the Executive Secretary. Final cover shall consist of materials specified in the permit application and approved by the Executive Secretary prior to closure.
13. Dead Animals Animal carcasses shall be covered immediately with soil or other waste.
14. Roads All roads used for transporting waste into the cells for disposal shall be improved and maintained as necessary to assure safe and reliable all-weather access to the disposal area.
15. Security A locked gate shall be installed to prevent vehicular access to the site during closed hours. Fencing or other measures shall be taken as necessary to prevent access of persons or livestock by other routes. Construction plans for the security measures shall be submitted by the County and approved by the Executive Secretary prior to construction. Security measures must be in place prior to the acceptance of waste.
16. Run-On Control Construction plans for a run-on/run-off system for the prevention of surface water run-on/run-off in and around the facility operating area shall be submitted by the County and approved by the Executive Secretary prior to construction. Post closure run-on/run-off control consisting of contouring and sloping in association with diversion ditches and other technical devices deemed necessary shall be implemented. Suitable vegetation shall be established on these controls for stability and erosion prevention. All run-on control structures will be in place prior to acceptance of waste.



17. Burning of Waste Intentional burning of solid waste is prohibited and a violation of R315-303-5(2)(b) UAC. All accidental fires shall be extinguished as soon as possible.
18. Liquids Disposal of containers larger than five gallons holding liquids, noncontainerized liquids, sludge containing free liquids, or any waste containing free liquids are prohibited.
19. Ground Water Quality Protection Regulations The Permittee shall comply with the Ground Water Quality Protection Regulations (R317-6) such that no wastes will be placed which cause a discharge of a pollutant or where there is probable cause to believe wastes will cause pollution of waters of the State. Discharge of a pollutant shall be considered a violation of this permit.
20. Leachate Monitoring and Collection Construction plans for the leachate collection/monitoring system shall be submitted by the County and approved by the Executive Secretary prior to construction. A series of perforated collection pipes installed above the landfill clay liner will be monitored periodically for accumulation of leachate. Leachate collection will be implemented on a continuing basis as dictated by ongoing monitoring.
21. Leachate Monitoring Plan A leachate monitoring plan describing monitoring protocol will be submitted by the County to the Executive Secretary for approval prior to construction. Leachate monitoring shall be conducted as part of the quarterly inspections conducted by the landfill manager.
22. Recordkeeping The Permittee or operator of the facility shall maintain on-site or at another location approved by the Executive Secretary a daily operating record including: weights or volumes of waste received, number of vehicles entering, the types of waste received, (if available), major deviations from the approved plan of operation, training and notification procedures, results of gas and leachate monitoring, an inspection log or summary, closure and post-closure care plans, closure cost estimates and financial assurance documentation.
23. Reporting The Permittee shall prepare and submit an Annual Report to the Executive Secretary which shall include: period covered by the report, annual quantity of waste received, estimated in-place density of waste, the annual update of the financial assurance mechanism and closure cost estimate, results of gas and leachate monitoring, and training programs completed.
24. Financial Assurance A financial assurance mechanism proposed by the Permittee shall be established prior to receipt of waste. Contributions to the fund shall be made as described

in the permit application. An annual revision of closure costs and financial assurance funding shall be submitted to the Executive Secretary. The financial assurance fund shall be adequately funded to provide for the cost of closure at any stage or phase or anytime during the life of the landfill.

25. Transfers This permit may be transferred to a new permittee by meeting the requirements of the Permit Transfer provision in R315-310-9 UAC.
26. Status Notification Eighteen months from the date of this permit the Executive Secretary shall be notified in writing of the status of the construction of this facility unless construction is complete and operation has commenced.
27. Permit Modifications Modifications to this permit may be made by the permitting agency as necessary as a result of statutory or regulatory changes. The Permittee will be given written notice of any permit modification.
28. Land acquisition This permit is valid for the facility described under the location above. If the County is not able to acquire the deed to the site property from the Bureau of Land Management this permit is revoked.
29. Notification Before waste can be accepted at the facility the owner/ operator shall notify the Executive Secretary of the Utah Solid and Hazardous Waste Control Board in writing that he has read, understands and has become familiar with this permit and the appropriate rules which regulate the operation of this facility.

Signed Dennis R. Downs Date 15 Feb., 1994  
Dennis R. Downs, Executive Secretary  
Utah Solid and Hazardous Waste Control Board  
Department of Environmental Quality  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880

**UTAH SOLID AND HAZARDOUS WASTE CONTROL BOARD**

**SOLID WASTE PERMIT MODIFICATION**

**CLASS I LANDFILL**

Pursuant to the provisions of the *Utah Solid and Hazardous Waste Act*, Title 19, Chapter 6, Utah Code Annotated (UCA) 1953, as amended (the Act) and the *Utah Solid Waste Permitting and Management Rules*, Utah Administrative Code (UAC) R315-301 through 320 (the Solid Waste Rules) adopted thereunder,

**San Juan County**

is hereby authorized to construct and operate a Class I Landfill located in T. 39 S., R. 22 E., Section 3, SWSW, S2WSESW (45 Acres), Section 4, S2SE (80 Acres), Section 9, NE (160 Acres), Section 10, W2NW, W2NENW, NWSWNW (110 Acres), SLBM; San Juan County, Utah as shown in the White Mesa Landfill Permit dated February 15, 1994 and modified as requested by San Juan County on November 2, 1994.

The operation of the landfill is subject to the condition that San Juan County (Permittee) meet the requirements set forth in the San Juan County Landfill permit.

Modification Effective date: May 2, 1995

Signed this 3 day of May, 1995.



Dennis R. Downs, Executive Secretary  
Utah Solid and Hazardous Waste Control Board



# State of Utah

## DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF SOLID AND HAZARDOUS WASTE

Michael O. Leavitt  
Governor  
Dianne R. Nielson, Ph.D.  
Executive Director  
Dennis R. Downs  
Director

288 North 1460 West  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880  
(801) 538-6170 Voice  
(801) 538-6715 Fax  
(801) 536-4414 T.D.D.

RECEIVED  
SALT LAKE COUNTY

MAY 08 1995

May 2, 1995

Rick M. Bailey  
Administrative Assistant  
San Juan County Commission  
117 South Main Street  
Monticello, Utah 84535

RE: Modification of Class I Landfill Permit

Dear Mr. Bailey:

Enclosed is the permit modification for your Class I landfill in San Juan County. The public comment period began January 4, 1995, and ended February 2, 1995.

If you have questions regarding the permit modification please call me or Wade Hansen at 538-6170.

Sincerely,

Ralph Bohn, Manager  
Solid Waste Section

c: David Ariotti, DEQ District Engineer  
Brian Bremner, Garfield County Engineer  
Gary Angott, M.S.P.H., Director, Southeastern Utah District Health Department  
Julie Orr, Indian Health Services

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**DRAFT**

**UTAH SOLID AND HAZARDOUS WASTE  
CONTROL BOARD**

**SOLID WASTE PLAN APPROVAL (PERMIT)**

(MODIFIED 11/22/94)

**PERMITTEE NAME:** ~~White Mesa Sanitary Landfill~~  
San Juan County Landfill

**PERMITTEE:** San Juan County  
~~Attn: Bill Reed~~

**ADDRESS:** San Juan County Courthouse  
117 South Main Street  
PO Box 9  
Monticello, Utah 84535  
~~(801) 477-3375~~  
(801) 587-3225

**TYPE OF PERMIT:** Class I Solid Waste Landfill

**PERMIT #:** 93-05

**LOCATION:** ~~Landfill site is located in T. 39 S.,~~  
~~R. 22 E., Section 10, SLMB,~~  
~~San Juan County, Utah~~  
Landfill Site is located in T. 39 S., R.  
22 E., Section 3, SWSW, S2WSESW (45 Acres)  
Section 4, S2SE (80 Acres), Section 9, NE  
(160 Acres), Section 10, W2NW, W2NENW,  
NWSWNW (110 Acres), SLMB;  
San Juan County, Utah

The permit application submitted by San Juan County in March of 1993 and revised June 11, 1993 and July 19, 1993 is incorporated by reference into this solid waste permit. All representations made in the permit application are a part of this permit. Where differences in wording exist between this permit and the application, the permit wording supersedes that of the application.

By this permit to operate, San Juan County (hereafter referred to as Permittee or County) shall be subject to the following conditions:

# DRAFT

1. General Operation: The Permittee shall operate the municipal landfill in accordance with all requirements of R315-302 and 303 Utah Administrative Code (UAC) unless otherwise noted in this permit. Any noncompliance with the permit or rules, other than activities authorized by a variance, constitutes a violation of UAC R315 and is grounds for appropriate enforcement action, permit termination, revocation and reissuance, modification, or denial of a permit renewal application.
2. Noncompliance In the event of noncompliance with the permit or rules, the Permittee shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are necessary to protect public health and the environment. Compliance with the terms of this permit does not constitute a defense to actions brought under any other State or Federal law.
3. Inspection All operational procedures as outlined in the permit application shall be followed. The landfill will be subject to inspection by the State and/or the Southeastern Utah District Health Department. A record of the inspection may be made by photographic, videotape, electronic, or other reasonable means.
4. Inspection Access The Permittee shall allow the Executive Secretary of the Utah Solid and Hazardous Waste Control Board, or an authorized representative, including representatives from the Southeastern Utah District Health Department, upon presentation of credentials, to enter during operating hours, and/or inspect at reasonable times any facilities, equipment, practices, or operations regulated or required under this permit.
5. Prohibited Waste No regulated quantity of hazardous waste as defined by R315-1 and R315-2 UAC or PCB's, as defined by R315-301(51), shall be accepted for treatment, storage, or disposal at the landfill. The receipt of such waste at the facility will constitute a violation of this permit and R315-303-5(7).
6. Acceptable Waste ~~This permit is for disposal of municipal and industrial nonhazardous waste from San Juan County only.~~ This permit is for the disposal of municipal and industrial nonhazardous waste from San Juan County, adjacent areas of the Navajo Nation, and Grand County. The landfill operator will inspect all waste loads to verify that no wastes other than municipal and industrial nonhazardous solid waste are disposed in the landfill. Requests for changes in the area from which waste may be accepted shall be submitted to the Executive Secretary for approval.
7. Revocation This permit is subject to revocation if any condition of this permit is not being met. The County will be notified in writing prior to any proposed revocation action

# DRAFT

and such action will be subject to all applicable hearing procedures established under the Utah Solid and Hazardous Waste Act, R315-319 UAC, and the Utah Administrative Procedures Act.

8. Expiration This permit shall expire five years from the effective date which will be the date the permit is signed by the Executive Secretary of the Utah Solid and Hazardous Waste Control Board. Application for permit renewal shall be made at least six months prior to the expiration of this permit.
9. Expansion Any expansion of the landfill facility beyond the areas designated in the permit application will require submittal of a new permit application in accordance with the requirements outlined in R315-310 UAC. Permittee may not begin construction of any expansion until approval from the Executive Secretary of the Utah Solid and Hazardous Waste Control Board is received in writing.
10. Training Permittee shall provide training for on-site supervisors in landfill operation, including waste load inspection, hazardous waste identification, and personal safety and protection.
11. Design QA/QC A Quality Assurance/Quality Control plan describing methods for procedures to confirm construction as specified in the permit shall be submitted by the County to the Executive Secretary for approval prior to construction.
12. Cover Cover material consisting of at least six inches of dirt or other suitable material as specified in the application shall be applied at the end of each working day. Alternative daily cover material may be used if approved by the Executive Secretary. Final cover shall consist of materials specified in the permit application and approved by the Executive Secretary prior to closure.
13. Dead Animals Animal carcasses shall be covered immediately with soil or other waste.
14. Roads All roads used for transporting waste into the cells for disposal shall be improved and maintained as necessary to assure safe and reliable all-weather access to the disposal area.
15. Security A locked gate shall be installed to prevent vehicular access to the site during closed hours. Fencing or other measures shall be taken as necessary to prevent access of persons or livestock by other routes. Construction plans for the security measures shall be submitted by the County and approved by the Executive Secretary prior to construction.

# DRAFT

Security measures must be in place prior to the acceptance of waste.

16. Run-On Control Construction plans for a run-on/run-off system for the prevention of surface water run-on/run-off in and around the facility operating area shall be submitted by the County and approved by the Executive Secretary prior to construction. Post closure run-on/run-off control consisting of contouring and sloping in association with diversion ditches and other technical devices deemed necessary shall be implemented. Suitable vegetation shall be established on these controls for stability and erosion prevention. All run-on control structures will be in place prior to acceptance of waste.
17. Burning of Waste Intentional burning of solid waste is prohibited and a violation of R315-303-5(2)(b) UAC. All accidental fires shall be extinguished as soon as possible.
18. Liquids Disposal of containers larger than five gallons holding liquids, noncontainerized liquids, sludge containing free liquids, or any waste containing free liquids are prohibited.
19. Ground Water Quality Protection Regulations The Permittee shall comply with the Ground Water Quality Protection Regulations (R317-6) such that no wastes will be placed which cause a discharge of a pollutant or where there is probable cause to believe wastes will cause pollution of waters of the State. Discharge of a pollutant shall be considered a violation of this permit.
20. Leachate Monitoring and Collection Construction plans for the leachate collection/monitoring system shall be submitted by the County and approved by the Executive Secretary prior to construction. A series of perforated collection pipes installed above the landfill clay liner will be monitored periodically for accumulation of leachate. Leachate collection will be implemented on a continuing basis as dictated by ongoing monitoring.
21. Leachate Monitoring Plan A leachate monitoring plan describing monitoring protocol will be submitted by the County to the Executive Secretary for approval prior to construction. Leachate monitoring shall be conducted as part of the quarterly inspections conducted by the landfill manager.
22. Recordkeeping The Permittee or operator of the facility shall maintain on-site or at another location approved by the Executive Secretary a daily operating record including: weights or volumes of waste received, number of vehicles entering, the types of waste received, (if available), major deviations from the approved plan of operation, training and notification procedures, results of gas and leachate monitoring, an inspection log or summary, closure and post-



# DRAFT

closure care plans, closure cost estimates and financial assurance documentation.

23. Reporting The Permittee shall prepare and submit an Annual Report to the Executive Secretary which shall include: period covered by the report, annual quantity of waste received, estimated in-place density of waste, the annual update of the financial assurance mechanism and closure cost estimate, results of gas and leachate monitoring, and training programs completed.
24. Financial Assurance A financial assurance mechanism proposed by the Permittee shall be established prior to receipt of waste. Contributions to the fund shall be made as described in the permit application. An annual revision of closure costs and financial assurance funding shall be submitted to the Executive Secretary. The financial assurance fund shall be adequately funded to provide for the cost of closure at any stage or phase or anytime during the life of the landfill.
25. Transfers This permit may be transferred to a new permittee by meeting the requirements of the Permit Transfer provision in R315-310-9 UAC.
26. Status Notification Eighteen months from the date of this permit the Executive Secretary shall be notified in writing of the status of the construction of this facility unless construction is complete and operation has commenced.
27. Permit Modifications Modifications to this permit may be made by the permitting agency as necessary as a result of statutory or regulatory changes. The Permittee will be given written notice of any permit modification.
28. Land acquisition This permit is valid for the facility described under the location above. If the County is not able to acquire the deed to the site property from the Bureau of Land Management this permit is revoked.
29. Notification Before waste can be accepted at the facility the owner/ operator shall notify the Executive Secretary of the Utah Solid and Hazardous Waste Control Board in writing that he has read, understands and has become familiar with this permit and the appropriate rules which regulate the operation of this facility.
30. Construction Approval and Request to Operate The permittee shall notify the Executive Secretary, prior to the acceptance of waste, that all the requirements of this permit have been met and all required facilities, structures, and accounts are in place as required. The facility may not accept waste until approval of the Executive Secretary is recieved.

**DRAFT**

Signed \_\_\_\_\_ Date \_\_\_\_\_, 1994

Dennis R. Downs, Executive Secretary  
Utah Solid and Hazardous Waste Control Board  
Department of Environmental Quality  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880

**APPENDIX C**  
**Request for Suspension of Composite Liner and**  
**Ground Water Monitoring Requirements (Vector, 1997)**

---

Application for Renewal  
San Juan County Landfill

**REQUEST FOR A SUSPENSION OF  
COMPOSITE LINER AND GROUND WATER  
MONITORING REQUIREMENTS  
AT THE  
SAN JUAN COUNTY LANDFILL  
SAN JUAN COUNTY, UTAH**

*Prepared for:*

**SAN JUAN COUNTY**  
117 South Main Street  
Monticello, Utah 84535  
(801) 587-3225

*Prepared by:*


**VECTOR ENGINEERING, INC.**  
1601 Fairview Avenue, Suite H  
Carson City, Nevada 89701  
(702) 883-7065

Job No. 975031.00  
December, 1997


## SIGNATURE PAGE

I certify as a qualified ground water scientist, as defined under 40 CFR 258.50(f), that the following request for a suspension of ground water monitoring and composite liner requirements was prepared in accordance with generally accepted hydrogeological practices applicable at the time the report was prepared. Vector Engineering, Inc., makes no other warranties, expressed or implied, as to the professional advice provided in this report. Recommendations contained in this report are based on review of existing regulations, published literature, and field investigations of the site. The following technical justification was prepared in accordance with the requirements of 40 CFR Part 258.

### VECTOR ENGINEERING, INC.

  
\_\_\_\_\_  
R. Breese Burnley, E.I.T.  
Project Professional

Approved:

  
\_\_\_\_\_  
Evan Nikirk, P.E.  
Project Manager

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## **1.0 INTRODUCTION**

The San Juan County Landfill is located approximately 11 miles south of the City of Blanding in San Juan County, Utah, and serves the residents of San Juan County. The landfill is situated at an approximate elevation of 5000 feet, just southwest of the intersection of U.S. Route 191 and State Route 262. As described by the Public Land Survey system and illustrated on Figure 1, it occupies the following portions of Township 39 South, Range 22 East, Salt Lake Baseline and Meridian: SW $\frac{1}{4}$  SW $\frac{1}{4}$  and S $\frac{1}{2}$  SE $\frac{1}{4}$  SW $\frac{1}{4}$ , section 3; S $\frac{1}{2}$  SE $\frac{1}{4}$ , section 4; NE $\frac{1}{4}$ , section 9; W $\frac{1}{2}$  NE $\frac{1}{4}$ , W $\frac{1}{2}$  NE $\frac{1}{4}$  NW $\frac{1}{4}$ , and NW $\frac{1}{4}$  SW $\frac{1}{4}$  NW $\frac{1}{4}$ , section 10. The site is an existing landfill which accepts approximately 20 tons of waste per day, and is therefore considered a Class I facility as defined by the Utah Solid Waste Permitting and Management Rules (UAC R513-301-2).

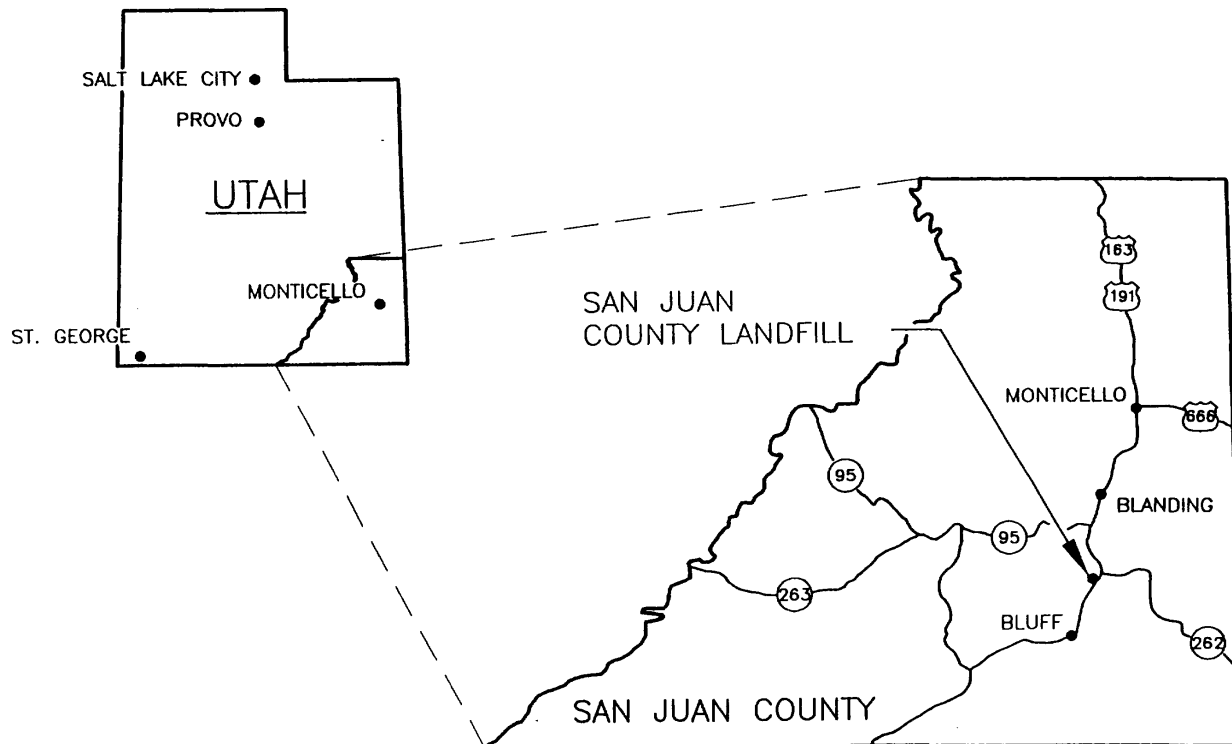
With the submittal and subsequent approval of the original permit application in early 1993, the San Juan County Landfill was approved for construction and operation without a ground water monitoring system. At that time, a detailed demonstration was not required to support the suspension of ground water monitoring requirements. With the subsequent adoption of Subtitle D requirements by the Utah Department of Environmental Quality (UDEQ), new requirements were promulgated which detailed the required components of a demonstration supporting a suspension of ground water monitoring requirements and the approval of landfill operation without a composite liner system. Because the five-year landfill operating permit is due to be reviewed in 1998, the scope of this suspension request was expanded from a liner waiver request to provide the supporting information required for a suspension of ground water monitoring requirements. It should be noted that a technical justification for the exclusion of a ground water monitoring system addresses the same issues which are critical to obtaining approval for operation without a liner system. Therefore, this request for a suspension of composite liner requirements will also serve as a technical justification for operation of the site without a ground water monitoring system.

As described above, this document constitutes a request for a suspension of composite liner and ground water monitoring requirements at the San Juan County Landfill, and consists of a technical justification in support of approval of such a request. In the development of this application, a site investigation and site-specific study of the hydrogeologic setting of the San Juan County Landfill were performed, and the volume of leachate potentially generated over the life of the facility was modeled using the Hydrologic Evaluation of Landfill Performance (version 3.06) software program (Schroeder et. al., 1994). Results of these studies indicate that the operation of the San Juan County Landfill is unlikely to result in a degradation of waters of the state, or to endanger human health or the environment. San Juan County is therefore requesting a suspension of composite liner and ground water monitoring system requirements at the San Juan County Landfill, as per Sections R315-308-1(3) and R315-303-4(3)(c) of the Utah Administrative Code (UAC).

## **2.0 LEGAL BASIS**

The regulatory basis for obtaining a suspension of composite liner and ground water monitoring criteria lies in the provisions of the State of Utah, Department of Environmental Quality Solid Waste Permitting and Management Rules, R315-301 through 320. The basis of a technical justification for operation of a landfill without a liner system can be found in the provisions of Section R315-303-4 of the UAC, which states that an owner or operator may use, as approved by the Executive Secretary, alternative design, operating practices, and location characteristics which will minimize the migration of solid waste constituents or leachate into the surface or ground water, and which are at least as effective as the liners of Subsections R315-303-4(3)(a) or (b). The owner or operator must also demonstrate that the standard of Subsection R315-303-3(1), which states that an owner or operator shall not contaminate the ground water underlying a facility, can be met. Additionally, the demonstration must be approved by the Executive Secretary, and must be based upon the hydrogeologic setting of the facility and surrounding land, the climatic characteristics of the area, the volume and physical and





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LOCATION MAP

REQUEST FOR SUSPENSION  
SAN JUAN COUNTY LANDFILL  
SAN JUAN COUNTY, UTAH

FIGURE

**1**

chemical characteristics of the anticipated leachate, and prediction of contaminant fate and transport in the subsurface that maximize contaminant migration and consider impacts on human health and the environment.

Similarly, the basis of a technical justification supporting a suspension of ground water monitoring requirements can be found in the provisions of Section R315-308 of the UAC. Utah Administrative Code (UAC) Section R315-308-1(3) states that the requirements for ground water monitoring as set forth in UAC Section R315-308-2, "may be suspended by the Executive Secretary if the owner or operator of a solid waste disposal facility can demonstrate that there is no potential for migration of hazardous constituents from the facility to the ground water during the active life of the facility and the post-closure care period." According to UAC Section R315-308-1(3)(a,b), the demonstration must be based on measurements collected at specific field sites and the sampling and analysis of physical, chemical, and biological processes affecting the fate and transportation of contaminants; and, predictions of the fate and transportation of contaminants which are based on the maximum possible distance of the migration of contaminants and a consideration of the impacts on public health and safety and the environment.

As required by both Sections R315-303-4 and R315-308-1, this technical justification supporting a request for a suspension of composite liner and ground water monitoring requirements demonstrates that, based on site-specific physical and operational characteristics, operation of this site is consistent with the protection of public health and the environment, and the protection of waters of the state from degradation by pollutants or contaminants. It shows that the San Juan County Landfill is unlikely to produce a significant amount of leachate or pollute or degrade waters of the state, and therefore will not require monitoring of ground water or the installation of a liner system.

### **3.0 SCOPE OF INVESTIGATION**

A sound technical justification for a suspension of composite liner and ground water monitoring requirements must utilize site-specific data, such as the geologic and structural setting, climate, hydrologic environment, and design and operational controls, to demonstrate that substantial quantities of leachate will not be generated. It must also show that, if leachate is generated, it will not adversely impact ground water and will therefore not endanger human health or the environment.

The most important factor affecting leachate generation and migration at the San Juan County Landfill is the availability of water, which is dependent upon the climatic and hydrogeologic setting and the design and operation of the site. Therefore, initial investigations for this project focused on a literature review of published and unpublished data on the regional and local climatic, hydrologic, and geologic setting of the area. After quantifying the available information, reverse circulation drilling was employed in order to evaluate both the surface and subsurface characteristics of the site. Based on these site-specific data, the potential for leachate to be generated at the landfill was modeled using Version 3.06 of the HELP computer program (Schroeder et. al., 1994). Results of this investigation are presented in subsequent sections of this report.

### **4.0 CLIMATE**

The climate in the general vicinity of the landfill ranges from semiarid in the lower elevations to sub-humid at higher elevations in the nearby mountains. Average annual precipitation ranges from eight inches near Bluff, Utah, approximately 11 miles south of the site, to greater than 12 inches near Blanding, Utah, approximately 15 miles north of the site (NOAA, 1992). Most of the precipitation received in the area occurs during the months from July through January. Precipitation in the summer months mainly occurs in the form of high-intensity thunderstorms. However, much of the precipitation during October through April may fall as snow since average daily temperatures in the area are at or below freezing most of the time during these months. Monthly average temperatures in the area for

January are 27.3°F and 28.7°F at Blanding and Bluff, Utah, respectively, while average temperatures for July at Blanding and Bluff are 73.3°F and 77.6°F, respectively. Maximum temperatures may exceed 95°F at Bluff, Utah in the summer, while minimum temperatures may be less than 16°F at Blanding, Utah in the winter months (NOAA, 1992). Evaporation rates in the area vary from 45 inches in the mountains to 65 inches along the San Juan River. These rates are average annual evaporation rates based on evaporation from open bodies of fresh water (Avery, 1986).

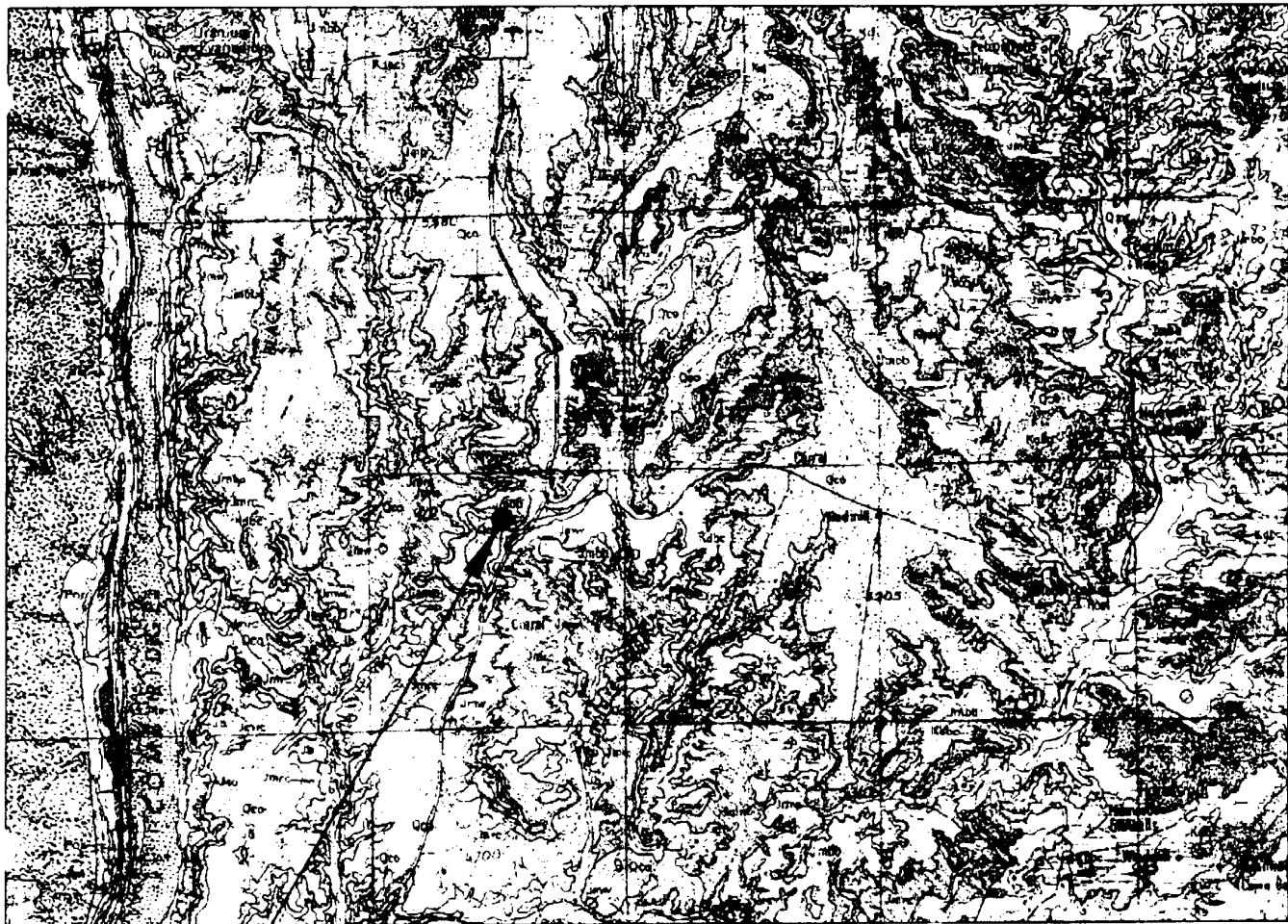
### 5.0 GENERAL GEOLOGIC SETTING

The San Juan County Landfill is located on the Big Bench Mesa, a 5,000-foot-high plateau in the Blanding Basin of southeastern Utah. The Blanding Basin is bordered on the west by the Comb Ridge and the Monument Upwarp, on the east by the Mesa Verde Structural Basin, on the south by the San Juan River, and on the north by the Abajo Mountains and the Great Sage Plain. Published geologic mapping of the area which encompasses the San Juan County Landfill is fairly extensive due to the close proximity of several significant petroleum and gas production fields. Figure 2 presents the geologic coverage of the landfill site and southeastern Utah as reported by Hintze and Stokes (1964). Figure 3 illustrates the major stratigraphic units of San Juan County (Howells, 1990).

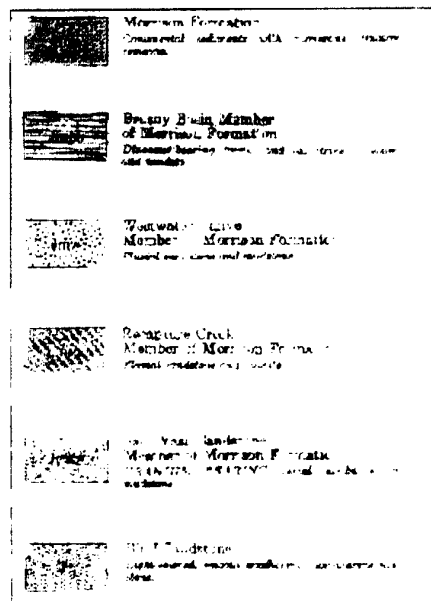
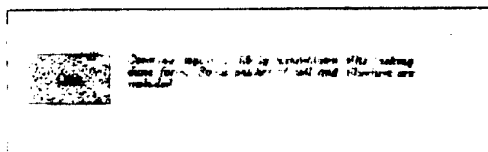
Based on the results of the site investigation and a review of published geologic maps of the area, surficial soils at the site are dominantly Quaternary alluvial and eolian sediments comprised of reddish-brown, very fine silty sand. This surface soil varies in thickness across the site from a thin veneer to almost 20 feet, and is probably derived from the sandstone layers which form mesa caps in the landfill vicinity. The silty sand is underlain by the Brushy Basin Member of the Morrison Formation. The Morrison Formation underlies much of eastern San Juan County including the San Juan County Landfill. The Jurassic Brushy Basin Member consists of very low permeability, fossil-bearing fluvial and lacustrine mudstone and sandstone (Gloyn et al., 1995). Stratigraphically underlying the Brushy Basin member are the Salt Wash, Recapture, Westwater Canyon and Bluff Sandstone Members. These members exhibit low to moderate permeability. The Salt Wash Member, which is correlative to the Bluff Sandstone Member in the southern part of the county, is a fine- to medium-grained sometimes conglomeratic sandstone interbedded with mudstone. The Bluff Sandstone Member, an eolian deposit that contains minor interbeds of fluvial material, is a massive, mostly fine- to medium-grained sandstone. The Bluff Sandstone is 350 feet thick near the town of Bluff, Utah, thinning northward and finally pinching out near Blanding, Utah. Boring logs obtained from a ground water exploration study conducted to the west and south of the site indicates that the Morrison Formation is about 480 feet thick west of the site, with the Bluff Sandstone Member making up 200 feet of the Morrison Formation (Feltis, 1966).

The stratigraphy immediately underlying the Morrison Formation consists of the Wanakah Formation. This formation consists of very low to low permeability marginal-marine, tidal-flat and fluvial facies consisting of calcareous and gypsiferous, laminated shale, and very fine-grained sandstone (Gloyn, et al., 1995). Borings drilled just west of the landfill indicate that the approximate thickness of the Wanakah Formation is 200 feet.

According to Hecker (1993) and Anderson and Miller (1979), Quaternary tectonism has been largely absent from eastern Utah. The significant exception are areas located in the Paradox Basin, north of Monticello, where late Tertiary to Quaternary dissolution collapse of large salt anticlines and additional salt flowage have caused the development of collapsed surface features in association with localized faulting. The closest area of known faulting, based on a Quaternary Fault Map of Utah (Anderson and Miller, 1979), is approximately 40 miles north of the San Juan County Landfill. These faults are believed to have originated from salt dissolution and not from tectonic activities. The closest area of faulting believed to be associated with tectonic processes is located approximately 47 miles to the northwest, adjacent to Cataract Canyon.



SAN JUAN COUNTY LANDFILL  
(APPROXIMATE LOCATION)



Map modified from Geologic Map of Southeastern Utah (Hintze and Stokes, 1964).

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SURFACE GEOLOGY

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SAN JUAN COUNTY, UTAH

FIGURE

**2**

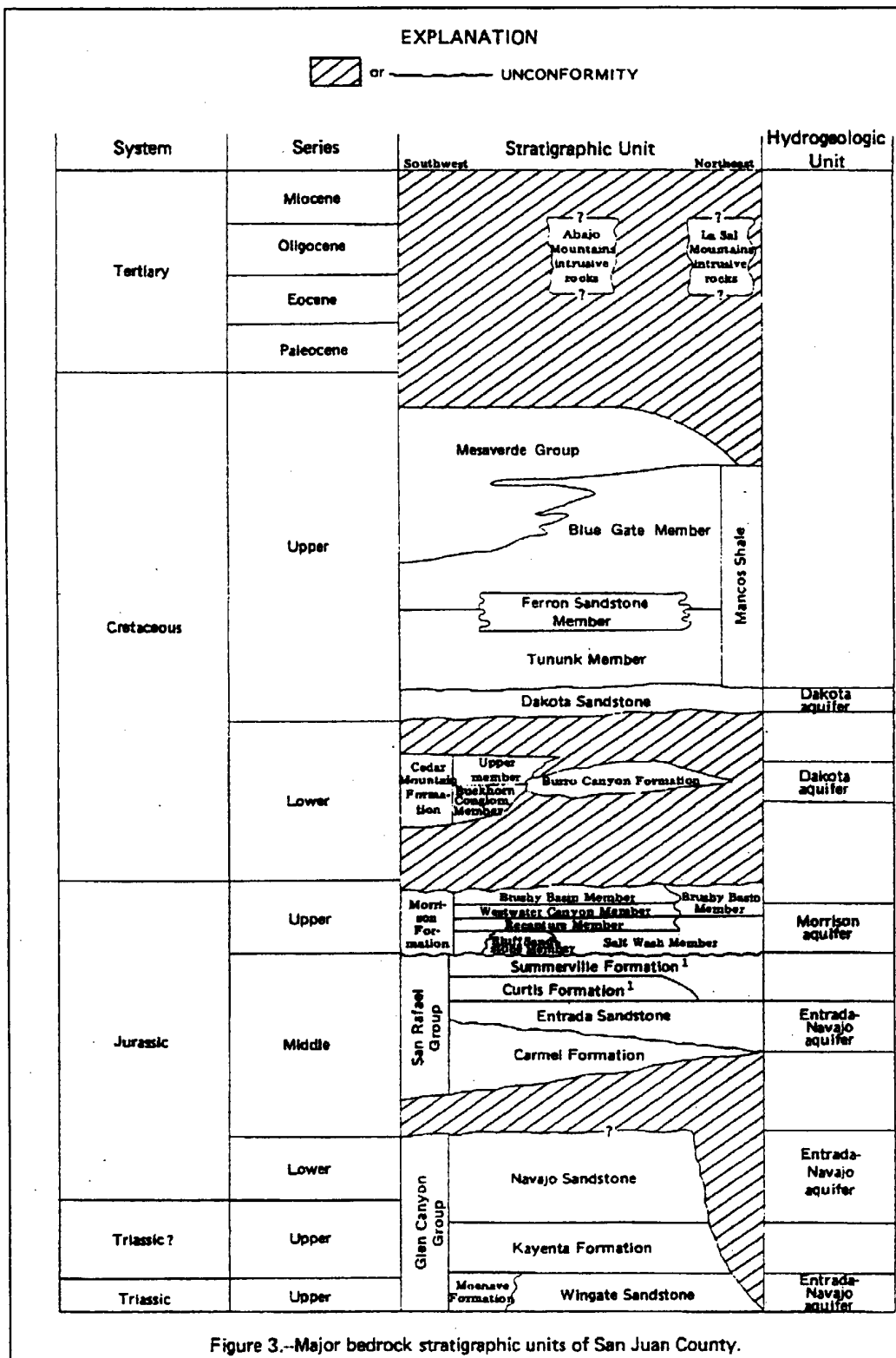


Figure 3.--Major bedrock stratigraphic units of San Juan County.

Figure modified from from Howells (1990).

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SCHMATIC GEOLOGIC CROSS SECTION

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SAN JUAN COUNTY, UTAH

FIGURE

**3**

## **6.0 GENERAL HYDROLOGIC SETTING**

In the Blanding Basin, the uniform and laterally continuous sub-horizontal layering of low-permeability and higher-permeability sediments has created several independent, parallel aquifer systems that generally flow south toward the San Juan River. The major water-yielding aquifers in the basin have been labeled according to the first letter of the formation in which they reside. The five major aquifers are designated as P, C, N, M and D and are listed in order of decreasing depth. Although they are treated as individual aquifers, little is known about the possibility of vertical interaction between the aquifers due to faulting and fractures (Avery, 1986).

### **6.1 "D" Aquifer Characteristics**

The D aquifer, or Dakota aquifer, is highly-fragmented and commonly is only found in the caps of the highest mesas in the area (Howells, 1990). Recharge, discharge, and flow directions vary due to the fragmented nature of the aquifer. The D aquifer is not present in the area of the San Juan County Landfill since the Dakota Formation has already been removed through the process of erosion.

### **6.2 "M" Aquifer Characteristics**

The M aquifer, or Morrison aquifer is limited to the eastern portion of San Juan County by Comb Ridge (Gloyn et al., 1995). The M aquifer is present below the San Juan County Landfill and is the shallowest of all the aquifers in the area of the landfill. The San Juan County Landfill is situated atop a section of the Brushy Basin Member of the Morrison Formation. The very low permeability of the Brushy Basin Member causes this member to act as a barrier to the movement of water, except where fractured or faulted. The Brushy Basin Member is located above the Bluff Sandstone and Salt Wash Members of the Morrison Formation (Figure 3). These two members are the major water bearing members for the Morrison aquifer.

Due to the presence of the confining layer above the Morrison aquifer, recharge and discharge generally occurs via stream beds that have downcut through the Brushy Basin Member, along the perimeter of intrusive igneous members such as the Abajo Mountains, or by interformational leakage via fractures and faults (Avery, 1986). The general direction of ground water flow is to the south. Water in the aquifer is usually under water-table conditions where the units are not overlain by the Brushy Basin Member. Where the member is overlain by the Brushy Basin Member, the aquifer may be under artesian conditions. Water in the Bluff Sandstone Member is under artesian conditions southeast of the Abajo Mountains; wells near Montezuma Creek and the town of Bluff are under artesian conditions (Howells, 1990). Water from the Morrison aquifer ranges from fresh to moderately saline depending on travel distance from recharge zones.

### **6.3 "N" Aquifer Characteristics**

The "N" aquifer or Navajo aquifer, can be found in the Entrada Sandstone, Carmel Formation, Navajo Sandstone, Kayenta Formation, and Wingate Sandstone. This aquifer, with the Navajo Sandstone making up the major unit of the aquifer, is a major source of potable ground water for the county. The Navajo aquifer is separated from the Morrison aquifer by the Summerville and Curtis Formations which may be up to 500 feet thick. These formations have very low to low permeabilities and are considered a barrier to interformational movement of water between the Morrison and Navajo aquifers except where fractured or faulted.

### **6.4 "P" and "C" Aquifer Characteristics**

The "P" and "C" aquifers are the most extensive, deepest and least understood aquifers in the area. They are isolated from the Navajo aquifer by Chinle and Moenkopi Formations. The major water bearing units for the "P" aquifer are the Cutler Group and the Cedar Mesa Sandstone. The major water bearing unit for the "C" aquifer is the DeChelly Sandstone (Gloyn et al., 1995). The "P"

aquifer generally exists north of the San Juan River while the "C" aquifer is generally located south of the San Juan River.

### **6.5 Occurrence and Depth of Ground Water**

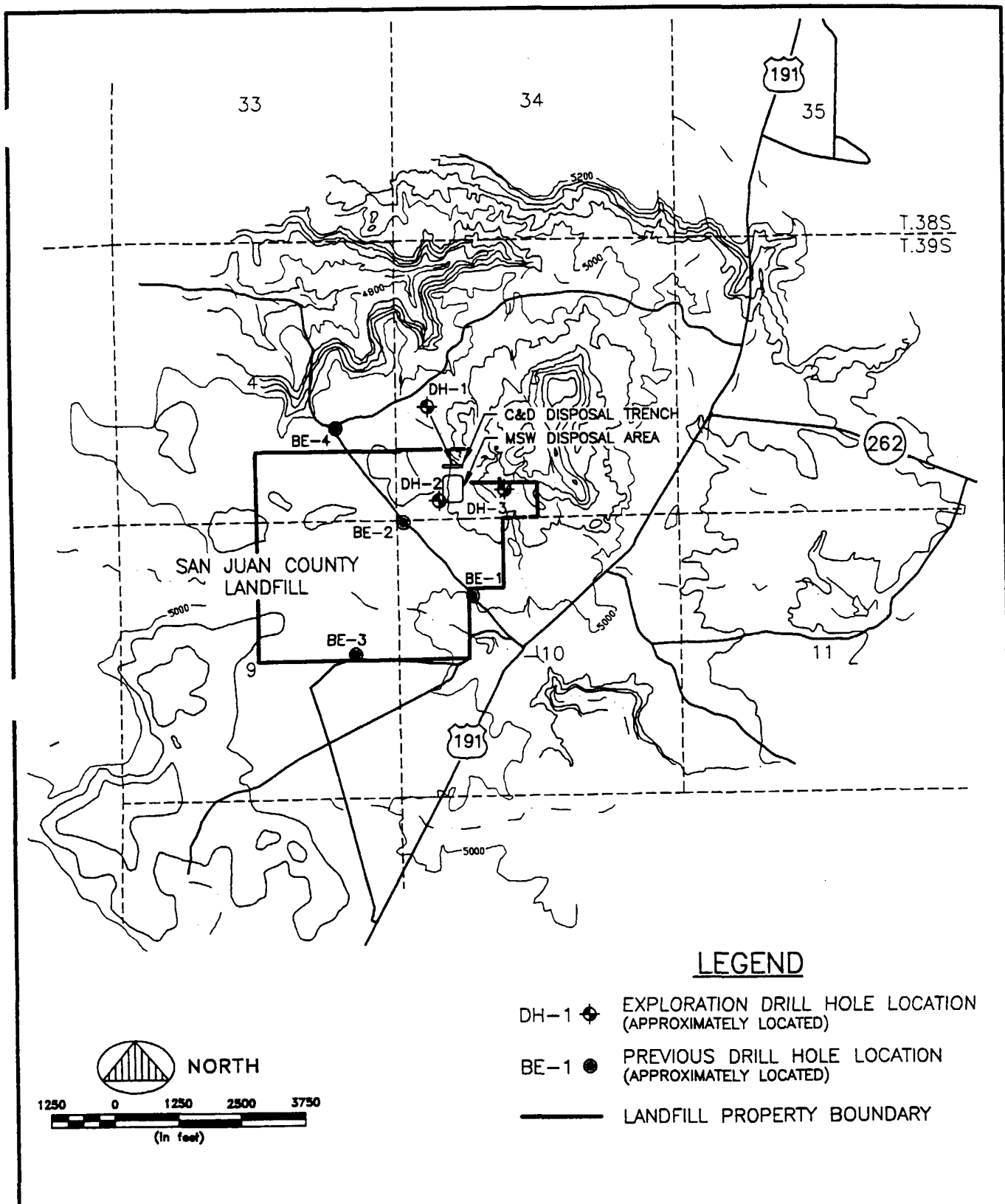
The Morrison aquifer is the shallowest aquifer beneath the San Juan County Landfill. During the development of the permit application in 1993, four exploratory borings were drilled at the landfill site by Bayles Exploration of Blanding, Utah. Figure 4, Drill Hole Location Map, illustrates the location of these borings with respect to the landfill location. Three of the borings (BE-2, BE-3 and BE-4) were drilled to a depth of 200 feet. The fourth boring (BE-1) was originally terminated at 200 feet, but was re-entered and drilled to a depth of approximately 780 feet below ground surface. Free water was encountered in the fourth boring at a depth of 770 feet. The flow rate of ground water into the boring at 780 feet was determined to be on the order of 30 gallons per minute.

### **7.0 FIELD INVESTIGATION**

Three vertical holes were drilled at the site on September 24 and 25, 1997, by PC Exploration of Centerville, Utah. Reverse circulation drilling methods were employed to drill three holes (DH-1, DH-2, and DH-3) to total depths of 100 feet below ground surface. All drill holes were logged in the field and samples were field-classified according to the Unified Soil Classification System (USCS). Detailed boring logs have been included as Appendix A.

Drill hole locations are illustrated on Figure 4, Drill Hole Location Map. Relatively undisturbed soil samples were collected using a split-spoon sampler driven by a 140-pound hammer dropped over a thirty-inch interval. Drilling confirmed the presence of variably indurated, laterally continuous, relatively thick layers of mudstone, siltstone, and sandstone beneath the landfill site. Variably indurated mudstone to siltstone was the predominant material encountered in all of the drill holes. The relatively thick sequences of mudstone contained a number of zones which exhibited an increased sand or silt content. Several layers of moderately to well indurated sandstone were encountered, and were typically more lithified than the intervening mudstone. The upper five feet in DH-2 and the upper 17.5 feet in DH-3 were comprised of very fine, reddish brown very silty sand. This material was previously removed from the surface at DH-1 during the excavation of the construction and demolition waste disposal cell. The same silty sand was observed at the surface over all of the flat-lying, undisturbed portions of the site. The field observations correspond to the general geologic description for the Brushy Basin Member upon which the landfill is located. The upper most layer is made up of Quaternary aeolian deposits of fine-grained silty sand, referred to as covering deposits (Qco) by Hintze and Stokes (1964). Immediately underlying this layer is the Brushy Basin member of the Morrison Formation (Jmbb) which consists of fluvial shale, sandstone, mudstone and siltstone. The description of the Brushy Basin Member reported by Hintz and Stokes (1964) correlates well with observations made in the field.

Laboratory tests were performed on two samples collected during the site investigation. One relatively undisturbed sample was collected from a depth of approximately 10 feet in drill hole DH-2. A second bulk sample was obtained from a depth of approximately two feet below the base of the existing disposal cell and just south of the waste mass. Grain size distribution analyses of the sample obtained from DH-2 indicated that the material can be classified according to the Unified Soil Classification System (USCS) as a fat clay (CH) with approximately 88 percent of the material passing the #200 sieve. In addition, Atterberg limits testing of the DH-2 sample resulted in a liquid limit and plasticity index of 130 and 97, respectively. In other words, the fat clay is also a swelling clay capable of retaining 130 percent of its own weight in water. The same sample was subjected to a flexible wall permeability test, which indicated an undisturbed, saturated permeability of  $5 \times 10^{-8}$  centimeters per second (cm/sec). Figure 4 illustrates the locations of the drill holes with respect to the landfill. The bulk sample was taken approximately 400 feet east of drill hole DH-2 within the municipal solid waste



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	REQUEST FOR SUSPENSION SAN JUAN COUNTY LANDFILL SAN JUAN COUNTY, UTAH	



disposal cell. Grain size distribution analyses indicated that the bulk sample is also classified as a fat clay (CH) with approximately 93 percent of the material passing the #200 sieve. The material exhibits a liquid limit and plasticity index of 136 and 101, respectively. Permeability tests were not performed on the bulk sample. Initial moisture contents for the sample from DH-2 and the bulk sample were measured at 19.0 and 23.2 percent by weight, respectively. Laboratory results are contained in Appendix B. Based on field observations and the results of laboratory testing, both samples appear to come from the same lithologic unit.

Numerous layers were encountered at similar depths in all three borings which were field classified as variably indurated fine-grained sediments. Drill logs are included in Appendix A. Given the consistent sequence and physical properties of the materials observed in the drill cuttings for all three holes, it is postulated that the units which underlie the landfill are laterally correlatable at the scale of the landfill property. In addition, surface or subsurface evidence of faulting was not observed anywhere in the landfill vicinity, or indicated in the review of available literature performed as part of this investigation. Based on this information, it is unlikely that there are preferential flow paths to ground water over 700 feet below the San Juan County Landfill. It should be noted that the total thickness of the laterally-continuous, very low permeability layers encountered beneath the landfill is in excess of the three-foot layer specified in alternative liner requirements as defined in UAC Section R315-303-4(3)(b).

Field observations and a review of available literature indicates that the sediments underlying the landfill are laterally continuous on the scale of the landfill property. Based on the description and occurrence of the Brushy Basin member described by Avery (1986) and illustrated on Figure 2, Geologic Map of Southeast Utah (Hintze and Stokes, 1964), this unit can also be laterally correlated across the top of the mesa on which the landfill is located. The low-permeability, laterally continuous layers beneath the landfill will act as a natural barrier to vertical flow in the subsurface. Based on the data and interpretations developed from a site-specific field investigation and presented in preceding sections, the following conclusions can be drawn:

- the stratigraphy underlying the San Juan County Landfill was shown to contain numerous layers of relatively impermeable siltstone, sandstone, and mudstone;
- subsurface layers are laterally continuous on the scale of the landfill property;
- the first water-bearing zone encountered beneath the site exists at an approximate depth of 770 feet;
- based on interpretations by Gloyn et al. (1995), ground water beneath the site most likely exists under confined conditions with an unknown average pressure head;
- laboratory analyses on the variably-indurated mudstone which immediately underlies the landfill yielded an undisturbed permeability of  $5 \times 10^{-8}$  cm/sec; and,
- the large thickness and low permeability of the underlying sediments exceed the alternative bottom liner requirements (UAC Section R315-303-4(3)(b)) of three feet of compacted soil having a permeability less than or equal to  $1 \times 10^{-7}$  cm/sec, and therefore act as an *in-situ* liner system.

Each of these conclusions supports the contention that the hydrogeologic conditions underlying the San Juan County Landfill are protective of ground water quality, and that operation of the site without a composite liner or ground water monitoring system is unlikely to cause degradation of surface or ground water.

## 8.0 LEACHATE GENERATION

As part of this justification for a suspension of ground water monitoring and composite liner requirements, an assessment of the potential of the landfill to generate leachate was performed. In

August 1993, the U.S. Environmental Protection Agency's (EPA) Environmental Research Laboratory released a study titled *Leachate Generation and Migration at Subtitle D Facilities: A Summary and Review of Processes and Mathematical Models* (USEPA-ERL, 1993). The study outlined a number of factors affecting the volume of leachate generated, including availability of water, shape and physical characteristics of the landfill surface, condition of the refuse before and after compaction, and underlying soil conditions. Each of these factors is addressed below in the context of leachate production within the San Juan County Landfill. In addition, the *Hydrologic Evaluation of Landfill Performance* (HELP3, version 3.06) computer model developed by the U.S. Army Corps of Engineers Waterways Experiment Station was utilized to model the potential of the San Juan County Landfill to generate leachate.

### 8.1 Availability of Water

The availability of water is the single most important factor affecting leachate generation, and is dependent on precipitation, surface water run-on, ground water intrusion, irrigation, refuse decomposition, and the moisture content of waste. Each of these elements is discussed below in the context of its significance to leachate generation at the San Juan County Landfill.

*Precipitation* - The amount, intensity, frequency, type, and duration of precipitation events are important parameters affecting the quantity of leachate which may be generated at a site. Typically, only the volume of precipitation is considered in the prediction of the quantity of leachate generated. However, in the interpretation of the significance of precipitation to leachate generation in arid areas, it is important to consider the relationship between rainfall intensity and infiltration rates. If rainfall intensity is great enough, the infiltration capacity of the soils may not be sufficient to absorb all incoming precipitation. In this case, excess precipitation ponds at the surface and becomes available for run-off in the form of sheet or channelized flow (Freeze and Cherry, 1979). The net effect of increased run-off is a reduction in the amount of incoming precipitation available for infiltration, and therefore, a reduction in the amount of water available for leachate production. Because of surface water run-on controls at the San Juan County Landfill, the amount of precipitation available for leachate production is restricted to that amount which falls directly on the landfill surface minus the amount which is lost to evaporation and run-off from the landfill surface. Given the relatively high evaporation rates in the region (45 to 65 inches/year), the amount of precipitation available for leachate generation will likely be significantly less than the average annual precipitation of an estimated 10.4 inches per year (NOAA, 1992).

*Surface Water Run-On* - Run-on controls have already been constructed at the San Juan County Landfill. The majority of these controls consist of soil berms located around the active disposal cell designed to divert potential storm flows away from the waste mass. Pursuant to 40 CFR Part 258.26(a)(1), surface water run-on control systems will be augmented as the site develops and will prevent run-on to the active portion of the landfill during the peak discharge from a 25-year, 24-hour storm event. Additional run-on controls may consist of diversion drainage channels along the northern and eastern sections of future disposal cells. These controls will limit incoming water directly affecting the landfill to that amount of precipitation which falls within and directly on the surface of the landfill. Overland flow will not enter or infiltrate the landfill.

*Ground Water Intrusion* - As described in Section 7.0 of this report, ground water beneath the landfill site has been proven to be deeper than 700 feet. Therefore, ground water intrusion into the landfill during the active life and the period of closure/post-closure is highly unlikely and is not considered in the evaluation of the leachate generation potential of the landfill.

*Refuse Decomposition* - The degree and rate of biological decomposition of municipal waste vary with time, and depend on the rate of infiltration and the distribution of moisture. In general, microorganisms require moisture contents of 40 to 60 percent (0.40 to 0.60 vol/vol) in order to thrive, which exceeds the field capacities of typical municipal waste (Stegman, 1982). Little data is available on the biological decomposition of waste and the corresponding fluid production. However, fluid produced from microbial degradation of waste is considered to comprise a minor portion of the total quantity of leachate generated at a municipal solid waste landfill (Lu, et. al., 1985).

*Moisture Content of Waste* - Schroeder et al. (1994), state that the moisture content of fresh municipal waste ranges from 0.08 volume/volume (vol/vol) to 0.20 vol/vol, and averages approximately 0.12 vol/vol for compacted municipal solid waste. Because of the dry climate and high evaporation rates in the region, the actual in-place moisture content of waste at the San Juan County Landfill will likely approach the lower end of the reported range. Given the relatively low moisture contents of fresh waste and the mandatory exclusion of liquid wastes from landfills, the initial moisture content reported for waste does not occur in the form of a free liquid. With the exception of minor amounts of fluid derived from microbial degradation of waste, the initial moisture content within municipal waste only affects the storage capacity of the waste for additional liquids, and does not contribute free liquid to the leachate generation process.

## **8.2 Landfill Design and Operation**

As mentioned above, the availability of water is perhaps the single most important factor affecting the volume of leachate generated at a landfill facility. There are several important elements of landfill design and operation which will reduce or prevent leachate production at the San Juan County Landfill. These include cell configuration and active life, surface water controls, liquid waste exclusion, daily cover, and final cover. The design and operational elements discussed below have been included in the application for a permit to operate the site, which was submitted to UDEQ for approval in March of 1993 and has since been approved. All operational and design elements have been subject to approval by UDEQ prior to implementation at the San Juan County Landfill.

*Fill Methodology* - The filling method being employed at the San Juan County Landfill is a variation of the area-fill method. This method consists of excavating the entire disposal cell and filling the excavation in a series of lifts. To minimize the surface area of the active disposal face which is exposed to precipitation, the horizontal extent of the active disposal area is limited. By limiting the surface area exposed to direct precipitation, less moisture will be available for percolation through the waste mass and subsequent leachate generation.

Based on current disposal rates it is expected that each disposal cell will accept waste for two to five years. Cell progression will occur counter-clockwise around a small mesa located northeast of the current operating disposal cell. The approximate volume of waste to be disposed at the San Juan County Landfill is roughly 677,600 cubic yards per 20 acre parcel. The disposal volume is based on an assumed in place waste density of 900 pounds per cubic yard, seven foot lifts with six inch daily cover layers, a maximum disposal cell thickness of 40 feet, and 60 percent utilization rate of 20 acres (Beehive Engineering, 1993).

*Surface Water Run-On and Run-Off* - Surface water run-off from precipitation events will be diverted around and away from the landfill facility. Surface water diversion systems will continue to be constructed as needed to control the volume of flow resulting from a 24-hour, 25-year storm. All on-site surface water control structures will be maintained throughout the active life and the period of closure/post-closure to ensure continued effective operation. Prevention of run-on flow over or through the landfill will limit the amount of fluid available for percolation through the waste mass and

subsequent leachate generation. As a result, the volume of precipitation directly affecting the landfill will be limited to that amount of water falling directly upon the surface area of the active disposal area. Overland flow will not enter or infiltrate the landfill.

*Liquid Waste Exclusion Program* - The San Juan County Landfill will adhere to a strict liquid waste exclusion program. The exclusion of liquid waste from the municipal waste stream will effectively limit the amount of free liquid available for leachate production within the landfill.

*Daily Cover* - Solid waste accepted at the facility will be spread in thin layers (approximately two feet) and compacted. A minimum of six inches of cover material is applied to the active face on a daily basis. Compaction of the waste will decrease the potential pathways for fluid channeling within the waste mass. Consistent, daily application of cover will decrease the surface area of waste directly exposed to precipitation and will therefore minimize direct infiltration. A six-inch layer of compacted daily cover material will also enhance the capacity for retention of incoming moisture near the surface. These near-surface fluids will then be susceptible to evaporation and will be less likely to infiltrate the landfill. Interim cover will consist of a minimum of twelve inches of soil and will be applied to all waste surfaces not expected to receive additional waste for more than 90 days.

*Final Cover* - An 18-inch layer having a permeability less than or equal to  $1 \times 10^{-5}$  cm/sec and a six-inch erosion layer will be installed over areas of the landfill that have reached the final design elevation and exceed a continuous surface area of 3,000 square yards. The cover will be composed of at least 18 inches of earthen material which will serve as an infiltration barrier layer, which will then be covered by at least six inches of material designed to inhibit erosion and which is capable of supporting native plant growth. The integrity of the final cover system will be inspected and maintained throughout the active life and the through the 30-year post-closure period. In addition, the final cover will be re-vegetated in order to stabilize the surface and inhibit infiltration. An effective final cover design combined with closure/post-closure maintenance and re-vegetation will significantly reduce the amount of infiltration into the landfill during the period of post-closure, and will limit the total volume of fluid available for leachate generation and migration.

The design and operational elements discussed above (cell construction and active life, surface water controls, liquid waste exclusion, and the application of daily and final cover) all help to minimize the amount of fluid available for percolation and the processes of leachate generation. In so doing, these design and operational measures serve to protect the waters of the state from degradation, and protect human health and the environment.

## **9.0 HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE**

A conservative prediction of the quantity of leachate likely to be generated within the San Juan County Landfill has been performed in order to evaluate the need for, and appropriateness of, ground water monitoring and composite liner systems. The predicted maximum quantity of potential leachate was then evaluated in terms of both the geologic and hydrologic setting of the site. From this, the potential impact of site operations on the quality of ground water was assessed.

In order to estimate the maximum volume of leachate which may be generated, the HELP3 - Version 3.06 computer program (Schroeder et. al., 1994) was used to model site conditions at the San Juan County Landfill. The HELP3 model is a widely used and accepted computer program developed for the U.S. Environmental Protection Agency by the U.S. Army Corps of Engineers Waterways Experiment Station. It is a quasi-two-dimensional deterministic water budget model that uses daily climatological data, as well as site-specific material and design characteristics, to

perform sequential daily analyses which determine run-off, evapotranspiration, percolation, and lateral drainage for landfills.

### 9.1 *Model Sensitivity*

Vector has performed in-house sensitivity analyses on the HELP model during the course of previous studies which indicate that the quantity of leachate produced will decrease if either porosity, field capacity, or wilting point is increased. Conversely, the quantity of leachate produced will increase if initial moisture content or hydraulic conductivity is increased. Whenever possible, input parameters were selected so that the landfill model conservatively represents actual field conditions and results in an over-estimation of the volume of leachate produced within the landfill.

### 9.2 *Conceptual Model Used in Simulations*

The existing waste footprint covers approximately four acres; however, the final landfill configuration will cover a majority of the 640-acre landfill property. The proposed final thickness of the waste mass is approximately 40 feet (15 feet below grade, 25 feet above grade). The operational life of the site has not been calculated, but is estimated to be greater than 50 years (Application for the Proposed San Juan County Landfill, 1993). In order to arrive at a conservative (maximum) prediction of the quantity of leachate generated, the conceptual landfill model used in the HELP3 simulations consisted of the maximum thickness of waste (site capacity) covering a continuous area (20 acres) during an 80-year simulation period. The entire 20-acre site was considered to be open (without a final cover) for the duration of the simulation period.

### 9.3 *Selection of Input Parameters*

Input parameters for the HELP3 model simulations were derived from data collected during several site investigations, the results of laboratory testing of soil samples collected at the site (Appendix B), published data, and default parameters provided in the HELP3 software program.

Most of the input parameters for waste and daily cover soils were taken from a list of default material textures included in the HELP3 program. A copy of *Table 4 - Default Soil, Waste, and Geosynthetic Characteristics* from the HELP3 User's Manual (Schroeder, et. al., 1994) has been included in Appendix C. On-site borrow soils used for daily cover have been field classified as very fine silty sand. Based on the results of this testing, model default texture number 6, silty sand (SM) was chosen to represent daily cover soil. The classification chosen to represent waste, model default texture number 18, is representative of municipal solid waste compacted to approximately 900 pounds per cubic yard (lbs/cy). All input parameters are summarized in the output data file for the model simulation, which is included with this report in Appendix D. The following sections detail the rationale for the selection of each of the input parameters.

*Layer Thicknesses* - Layer thicknesses were selected so that the total modeled thickness was representative of the final configuration of the landfill (40 feet), and so that the ratio of waste to cover soil was approximately 3:1. In order to maintain this ratio within the prescribed 20-layer maximum of the program, it was necessary to utilize waste and soil layers of exaggerated thicknesses. During actual operations, waste layers are generally 24 inches or less in thickness prior to compaction, and are covered by approximately six inches of soil. However, alternating waste and soil layers are represented in the HELP3 model as 36 and 12 inches, respectively, for a cumulative thickness of 40 feet. The result is representative of the predicted final site conditions. By using the thickness of the final configuration to model the landfill over the entire operational life, the volume of waste available to contribute interstitial water to leachate generating processes is largely over-

estimated and leads to inherently conservative results since the HELP3 model considers moisture in excess of the wilting point to be available for gravity drainage.

*Field Capacity and Wilting Point* - Default field capacities and wilting points were used in the HELP modeling since moisture content and grain size distribution data were not available for daily cover soil and waste at the San Juan County Landfill.

*Initial Moisture Content* - In lieu of site-specific data, the initial moisture content of a material may be estimated by adding 25 percent of the difference between the wilting point and the field capacity to the wilting point of that material (Stephens and Coons, 1994). For default soil texture #6, the field capacity is 0.190 volume per volume (vol/vol), the wilting point is 0.085 vol/vol, and 25 percent of the difference between them equals 0.026 vol/vol. Therefore, the initial moisture content of daily cover material is estimated to be 0.111 vol/vol.

The initial moisture content of waste could not be calculated and, unless otherwise specified by the user, is automatically set by the HELP3 code equal to the field capacity. For model default texture 18, the initial moisture content and field capacity would therefore be automatically set at 0.292 vol/vol. However, Schroeder et. al. (1994), state that the moisture content of fresh municipal waste ranges from 0.08 to 0.20 volume per volume (vol/vol), and averages approximately 0.12 vol/vol. These values are much less than the model default field capacity of 0.292 vol/vol. Because of the semi-arid climate and the liquid waste exclusion program employed at the facility, the initial moisture content of waste going into the San Juan County Landfill is probably closer to the lower end of the moisture content range. However, in order to obtain a conservative estimate of leachate generation, three model simulations were performed, one using the reported average moisture content (0.12 vol/vol), the second using the upper end of the reported range (0.20 vol/vol) to represent the moisture content of waste, and the third using the upper end moisture content with a 12 inch thick barrier soil as the bottom layer. It should be noted that the model will consider all water in excess of wilting point to be available for gravity drainage. Therefore, within the model, that portion of the initial moisture of waste (0.12 or 0.20 vol/vol) in excess of wilting point (0.088 vol/vol) will actually contribute to the volume of fluid available for leachate production, and increase the amount of leachate predicted.

*Saturated Hydraulic Conductivity* - Laboratory permeability tests were not performed on daily cover soils or waste from the site. The default permeability value for texture number 6 of  $7.2 \times 10^{-4}$  cm/sec was used to represent the daily cover soil layers, while the default value of  $1.0 \times 10^{-3}$  cm/sec provided by the software program for default texture number 18 was used to represent the waste layers in the simulations.

*Climatic Data* - Average monthly precipitation and temperature data (Sellers and Hill, 1974) were obtained for Bluff and Blanding, Utah, which are located approximately 11 miles south and north of the landfill. The HELP3 program requires the use of one of the default cities within the computer code as a basis for generating site specific weather variables. A comparison of precipitation and temperature patterns of Bluff and Blanding, Utah with the default cities available in the HELP3 code for Utah indicated the closest similarity exists with precipitation and temperature patterns at Milford, Utah. Therefore, averaged site-specific precipitation and temperature data from Bluff and Blanding were used to supplement the precipitation and temperature data base for Milford, Utah contained in the HELP3 model. The supplemental and default climate data are processed

by the Agricultural Research Service's WGEN subroutine within the HELP3 model, and site-specific daily weather variables are generated. Additional climatic data required includes leaf area index and evaporative zone depth. In the interest of developing a conservative model, the leaf area index was selected as zero for unvegetated ground, and the evaporative zone depth was assumed to be 16 inches, which is the default depth for bare soil in the vicinity of Milford, Utah. It should be noted that the more vegetation a soil mass supports, the greater the depth of the evaporative zone. (By using bare soil, the evaporative zone depth is minimized, resulting in an over prediction of the amount of moisture entering the waste mass.)

*Run-off* - Run-off is computed within the HELP3 model using the run-off curve-number method of the U.S. Soil Conservation Service (USDA, 1972). In order to over-predict the volume of leachate generated, it was assumed that 100 percent of the precipitation falling within the site boundaries was available for infiltration, and that run-off from the landfill did not occur. In reality, due to the high-intensity, short-duration storms common in the region, a large portion of the average annual precipitation may be expected to exit the site as run-off.

#### 9.4 Model Simulation and Results

In order to estimate the volume of leachate potentially produced at the San Juan County Landfill, three HELP3 model simulations were performed for the conceptual operational life and post-closure period, and the site design outlined above. For simulations without a soil barrier layer, leachate production was assessed for 20 alternating layers of waste and cover material having a 3:1 ratio (respectively) and a 40-foot total thickness. Each of the 20 layers was considered to be a vertical percolation layer and the simulations were run over an 80-year period. For simulations with a soil barrier layer, leachate production was assessed for 18 alternating layers of waste and cover material underlain by a 12-inch barrier layer. The output files (results.out, outdry.out, and lined.out) for the simulations are contained in Appendix D. The results show that the average percolation from layer 20 (basal waste layer) is 0.085 inches per unit area per year when the initial moisture content of waste is set at the upper end of the reported range (0.20 vol/vol; Schroeder et. al., 1994). The predicted average percolation from layer 20 is 0.00076 inches per unit area per year when the initial moisture content is set at the reported average moisture content for waste (0.12 vol/vol; Schroeder et. al., 1994). Finally, when the landfill was modeled with a 12-inch thick soil barrier layer as the basal layer and an average moisture content of 0.20 vol/vol for waste, the HELP3 model predicted that there would be no percolation through the basal layer during the 80-year simulation period.

In effect, the results of these model runs indicate that, in the extremely dry climate in the region encompassing the landfill, the generation of leachate within the landfill is not significantly influenced by precipitation. In other words, the volume of leachate predicted by the HELP3 model for the San Juan County Landfill is dependent not upon the volume of incoming precipitation, but on the initial moisture content of the waste defined in the program and the availability of that moisture to gravity drainage.

#### 9.5 Discussion

Conservative values were chosen for most of the input parameters in the HELP3 simulations. Total landfill footprint open to precipitation, thickness of waste, and daily cover material are all over-estimated. Values for initial moisture content and saturated hydraulic conductivity were conservatively selected so that the calculated quantity of leachate produced would be over-estimated. Therefore, results of the model simulations are considered to be maximum values which are likely to over-estimate actual field conditions. The highest average annual percolation value predicted by the most conservative HELP3 model simulation (using the high

end of the moisture content range for waste) is 0.085 inches per unit area per year and is based on representative site conditions without installation of a composite liner or a final cover. Based on the information presented in Section 10.0, the highest predicted percolation rate is insignificant relative to the reported length of the landfill's operational life and post-closure period. It is therefore suggested that the small quantity of leachate potentially generated within the San Juan County Landfill will not migrate vertically and infiltrate the "uppermost aquifer" at a depth in excess of 700 feet beneath the waste.

#### **9.6 Model Limitations**

The model does not account for lateral inflow of ground water or surface water run-on. As documented in Section 8.1 of this report, ground water intrusion does not occur at the San Juan County Landfill. Design plans which include the control of surface water run-on, as described in Section 8.1 of this report, have been implemented as required as part of the issuance of a permit to operate the facility. Therefore, neither of these model limitations are considered to be of consequence in the evaluation of leachate generation at the facility.

The software program does not account for changes in the waste mass over time; the initial physical characteristics specified by the user remain constant for the duration of the simulation. Consequently, the program cannot account for temporal physical changes in the waste mass, nor can the filling process be modeled over time in a single simulation. In order to compensate for these potential limitations, an approximation of the final design configuration was used to model the landfill. Use of the final volume and thickness of waste throughout the entire time-frame of the simulation over-estimates the volume of interstitial fluid available for leachate generation. Therefore, the results represent a conservative, over-estimation of the volume of leachate which may be generated.

In order to compensate for the potential limitations of the HELP model listed above, numerous conservative assumptions were made in the selection of input parameters and throughout the modeling process. Each parameter was selected to over-estimate the final quantity of leachate predicted. It is therefore concluded that, because of the highly conservative parameters used in the model simulations, the quantity of leachate predicted to be generated within the San Juan County Landfill is over-estimated, and therefore is not undermined by the potential limitations in the HELP3 model.

#### **9.7 Summary**

It has been shown that the availability of water and the landfill design and operation are the most important factors affecting the generation of leachate within a landfill. By restricting the availability of water through operational and design controls, the volume of fluid available for leachate generation can be minimized. The elements of design and operation outlined in the sections above have been detailed in the application for a permit to operate the site, and were subject to review and approval by the Utah Department of Environmental Quality. It has also been shown through the use of the HELP3 computer program that the quantity of leachate which may be generated within the San Juan County Landfill is negligible.

#### **10.0 VERTICAL MIGRATION OF LEACHATE**

Solid waste regulations mandate that an estimate of the migration potential of contaminants from the site be performed. There are numerous physical, chemical, and biological processes which affect the fate and transport of contaminants both within the landfill and in the subsurface. Because approximately 770 feet of unsaturated sediments separate the base of the fill from ground water beneath the San Juan County Landfill, the fate of any contaminant generated at the site will be determined by flow in the unsaturated zone.



### 10.1 *Unsaturated Flow*

Flow in the unsaturated zone is a complicated and poorly understood process. It is treated mathematically in terms of both *gravity potential* and *moisture potential*. *Gravity potential* is the elevation head of a body of water expressed in units of length. *Moisture potential* is a negative pressure due to soil-water attraction and capillary forces. As moisture content decreases, *moisture potential* and capillary forces increase. Either potential may dominate, depending on the soil-moisture content. In general, when soil is not saturated, soil moisture flows downward by gravity flow through interconnected pores filled with water (Fetter, 1988).

Unsaturated flow is controlled by the unsaturated hydraulic conductivity. In contrast to saturated flow, unsaturated hydraulic conductivity is not a constant, but is directly proportional to volumetric moisture content. Descriptions of unsaturated flow are complicated by the fact that both conductivity and moisture potential vary with moisture content. In addition, unsaturated flow, by definition, involves the passing of multiple waves of infiltrating moisture. As a result, moisture contents and hydraulic conductivities are in a constant state of flux.

### 10.2 *Prediction of Vertical Travel Time*

As described above, unsaturated conditions exist in the subsurface at the San Juan County Landfill to a depth of 770 feet. Since waste disposal extends to 15 feet below ground surface, a minimum of 755 feet of unsaturated sediments separates the base of the landfill from ground water. A rigorous mathematical assessment of fluid and contaminant transport in the unsaturated zone requires a data base which is well beyond the scope of this study. However, in an effort to address the fate of contaminants in the subsurface, some conservative projections can be made regarding the volume of water required to induce and support advective flow through 755 vertical feet of lithologic section.

When soil is not saturated, soil moisture moves downward by gravity flow through interconnected pore spaces which are filled with water (Fetter, 1988). However, flow in the unsaturated zone will not occur until the field capacity of the material has been exceeded (Freeze and Cherry, 1979). Field capacity is defined as the soil-moisture content of a layer at the point at which the force of gravity acting on the water equals the surface tension, and gravity drainage ceases (Fetter, 1988). Therefore, an approximation of the fluid volume required to bring a vertical soil column to field capacity can be used to conservatively estimate the fluid volume which must be added to the column in order to induce gravity flow and advective contaminant transport.

Several assumptions were necessary in order to apply this exercise to the unsaturated soil beneath the San Juan County Landfill. First, it was assumed that contaminant transport from the base of the fill to ground water is by advective movement and gravity flow in a vertical column that is at field capacity. The conceptual vertical column is composed of 755 feet of uniform, well-graded silty sand with a surface area of one square foot. The default field capacity (0.190 vol/vol) for soil texture #6 and the calculated initial moisture content (0.111 vol/vol), obtained by adding 25 percent of the difference between the default wilting point and field capacity to the wilting point, are used to calculate the amount of leachate required to fill the 755-foot soil column beneath the landfill.

As stated above, gravity drainage in a vertical column will not occur until enough fluid is added to the column to raise the moisture content to the field capacity of that material. The initial moisture content of the conceptual column is 0.111 vol/vol, and the field capacity is 0.190 vol/vol. Therefore, the material has a capacity to retain an additional volume of moisture equal to 7.9 percent of the total volume of the vertical column before the field capacity is exceeded and gravity

flow begins. This value (0.079 vol/vol), multiplied by the volume of a vertical column of soil with dimensions of 755 feet by one foot by one foot, represents the amount of fluid which must be added to the column to bring it to field capacity. The result of this calculation indicates that approximately 59.6 cubic feet (446.1 gallons) of fluid are required to bring the entire soil column to field capacity.

If the amount of fluid required to bring a soil to field capacity is known, then the time required to supply that quantity of fluid can also be estimated. It must be assumed that the landfill remains open during the entire time period. If it is conservatively assumed that the San Juan County Landfill produces 0.085 inches of leachate per unit area per year (0.053 gallons per square foot per year) based on HELP3 modeling results, then the landfill must remain open without a final cover system and produce a consistent supply of leachate for more than 8,400 years to bring a one foot by one foot square soil column beneath the landfill to field capacity. In other words, the maximum leachate production rate predicted by the HELP3 model (0.085 inches per unit area per year), considered over the entire 80-year simulation period, is only sufficient to bring the top seven feet of the hypothetical soil column to field capacity.

The estimates of fluid production and migration rates presented in this section provide very simplified approximations of a complex system. The processes which govern contaminant transport are numerous and cannot be accurately represented through the use of very general assumptions. It should be emphasized that these calculations neglect many processes which greatly affect the rate of fluid and contaminant movement in the unsaturated zone. This exercise is intended only to provide an estimate of the order of magnitude of the potential problem. However, as a first order approximation, the San Juan County Landfill, with an active life of considerably less than 8,400 years, is unlikely to produce a quantity of leachate sufficient to bring the subsurface materials to field capacity, and to subsequently induce gravity flow and advective contaminant transport through more than 755 feet of sediments.

### **11.0 SUMMARY AND CONCLUSIONS**

Site-specific data for the San Juan County Landfill were developed using published and unpublished hydrogeologic information. The HELP3 - Version 3.06 software program was used to determine the volume of leachate potentially generated by the San Juan County Landfill based on site-specific design characteristics and climatic data. Subsequently, the amount of fluid required to induce vertical advective transport of contaminants in the unsaturated zone was estimated and assessed relative to the open life of the landfill. These site-specific investigations were performed in order to develop a sound technical justification for approval of a suspension of ground water monitoring and composite liner for the San Juan County Landfill.

The results of this study indicate that the continued operation of the San Juan County Landfill without ground water monitoring or composite liner systems is consistent with the protection of ground water quality. The supporting data can be separated into inter-dependent areas of study: hydrogeologic setting; design and operational elements; HELP3 modeling of the potential volume of leachate generated at the site; and, vertical migration of contaminants. Each of these areas of study is briefly summarized below.

- Average annual precipitation in the area is approximately 10.4 inches (NOAA, 1992), whereas average annual evaporation ranges from approximately 45 to 65 inches. In addition, ground water was encountered beneath the site at a depth of 770 feet below ground surface.

- Numerous design and operational elements, including the application of daily and final cover and the exclusion of liquid wastes from the landfill, reduce the total volume of fluid available for leachate generation within the landfill.
- Leachate generation predictions were performed using the HELP3 model and considered the final, full thickness of the waste mass. The configuration used in the modeling included 20 alternating layers of waste and cover soil, and 18 layers of waste and cover soil with a nineteenth layer comprising a 12-inch thick barrier soil. Initial moisture contents for all soil layers were set to just greater than its wilting point (0.111 vol/vol). Initial moisture contents of the waste layers were set at 0.20 vol/vol and 0.12 vol/vol, based on data contained in the *User's Guide for HELP Version 3* by Schroeder, et. al. (1994), which indicates that the initial moisture content of municipal solid waste ranges from 0.08 to 0.20 vol/vol, and averages 0.12 vol/vol. Utilizing the high end of the moisture content range results in a conservative estimate of leachate production and percolation of only 0.085 inches per unit area per year. Using the average reported moisture content for waste (Schroeder, et. al., 1994), the model predicted that the landfill would have an average annual percolation rate of 0.00076 inches per unit area per year. The third analysis used the higher than average moisture content but also included a 12-inch barrier layer predicted that there would be no percolation from the landfill. In effect, the HELP3 model results indicate that precipitation in the region has an insignificant effect on leachate generation within the San Juan County Landfill.
- The maximum conservative values obtained from the HELP3 model simulations (using the high end of the reported range for moisture content of waste) were utilized to provide a first approximation of the time of travel for leachate to migrate from the base of the landfill to the maximum depth explored. The exercise indicated more than 8,400 years of continuous, open operation and leachate generation would be required for leachate to migrate to a depth of 755 feet below the base of the landfill.

Based on the results of the investigation presented in this report, it is concluded that the surface and subsurface conditions at the San Juan County Landfill are favorable for the continued operation of the facility without installation of a ground water monitoring or composite liner system. In particular, the low average annual precipitation, the high rates of evapotranspiration, and a depth to ground water greater than 755 feet below the base of the landfill indicate that ground water is protected from degradation by contaminants from the landfill. The small quantity of leachate predicted to be generated even in the most conservative simulation precludes the possibility that the landfill can produce a quantity of leachate sufficient to bring the unsaturated sediments beneath the landfill to field capacity. In addition, the results from the vertical migration exercise indicates that over 8,400 years of continuous operation and leachate generation would be required to facilitate vertical migration to a depth of 755 feet below the base of the landfill. Therefore, vertical migration of contaminants from the base of the fill through the unsaturated zone to ground water is improbable. San Juan County therefore requests approval of the continued operation of the San Juan County Landfill without the installation of ground water monitoring or composite liner systems, as per the provisions of 40 CFR 258.50 and 258.40.

## 12.0 LIMITATIONS

This report was prepared in accordance with generally accepted geologic and hydrologic practices applicable at the time of preparation. Conclusions presented in this report are specific for this site and this client, and may not be expanded to include areas beyond this site. Vector Engineering, Inc., makes no other warranties, expressed or implied, as to the professional advice provided in this report.

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**APPENDIX A**  
**Drilling Logs**

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LOG OF BORING						DH-1
MATERIALS DESCRIPTION						PAGE 1 OF 1
DEPTH (feet)	STATIC WATER LEVEL	BLOW COUNTS PER SIX-INCH INTERVAL	SAMPLE TYPE	USCS SOIL CLASS	GRAPHIC LOG	
5		50-1"	<input checked="" type="checkbox"/>			0' - 6', FILL - Imported reddish-brown Silty SAND for road base
		50-2"	<input checked="" type="checkbox"/>			MUDSTONE, very silty, light greenish-grey, moist near surface, with occasional zones or interbeds of increased sand or silt content, varying degrees of induration grades to slightly sandier @ 2', light greyish-green
10		32/50-1"	<input checked="" type="checkbox"/>			grades sandier @ 10', light greenish-grey
15						with tan SILTSTONE interbeds @ 14', showing slight oxidation
20						grades back to green sandy MUDSTONE @ 15'
25						grades sandier @ 20'-30'
30						with interbedded light greenish-grey SANDSTONE and tan sandy SILTSTONE
35						grades to greenish-grey sandy MUDSTONE @ 35'
40						sand grains show slight oxidation
45						well-indurated, very fine-grained green SILTSTONE
50						grades to softer MUDSTONE @ 44', slightly moist, dark green
55						moderately to well indurated, slightly moist, sand grains are slightly to moderately oxidized
60						grades back to hard, well indurated SILTSTONE @ 59', dark green
65						SANDSTONE - light yellowish-green, fine to very fine, moderately to well indurated
70						grades to silty, light yellowish-brown (olive) @ 63'
75						MUDSTONE - dark greyish-green, moderately indurated
80						
85						harder with interbeds of very fine green SANDSTONE
90						red sandy seam @ 90'
95						
100						TD @ 100'; NFW

**VECTOR**

ENGINEERING, INC.  
1601 Fairview Avenue, Ste H  
Carson City, NV. 89701  
(702) 883-7065

PROJECT	SAN JUAN COUNTY	DRILLING COMPANY	PC EXPLORATION
LOCATION	WHITE MESA SANITARY LANDFILL	HAMMER DATA	140 lbs.
JOB NUMBER	975031.00	DATE DRILLED	9/24/97
LOGGED BY	RBB	TOTAL DEPTH OF HOLE	100'
DRILL RIG	REVERSE CIRCULATION	WATER ENCOUNTERED	NFW

LOG OF BORING						DH-2
MATERIALS DESCRIPTION						PAGE 1 OF 1
DEPTH (feet)	STATIC WATER LEVEL	BLOW COUNTS PER SIX-INCH INTERVAL	SAMPLE TYPE	USCS SOIL CLASS	GRAPHIC LOG	
0						0' - 3', FILL - imported gravelly sand road base
5						3' - 5', Silty SAND (SM), reddish-brown, slightly moist, very fine sand
10		22/21/23	☒			MUDSTONE, very silty, greenish-grey, moist near surface, with occasional lenses or interbeds of increased sand or silt content, varying degrees of induration
15		20/28/50	☒			sand seam @ 16'-17', medium sand, slightly oxidized
20						hard @ 17'-18'
25						reddish-brown silty clay @ 18'-19'
30						grades back to light brown mudstone, occasional hard, oxidized sandy lenses
35						grades to light brown and sandy
40						SANDSTONE - light yellowish-green, fine to very fine, moderately to well indurated
45						MUDSTONE, greyish-green, with occasional lenses of very fine sandstone and varying degrees of induration
50						grades sandier @ 55'
55						grades to grey and sandier @ 68'
60						SANDSTONE - light yellowish-green, fine to very fine, moderately to well indurated, with occasional lenses of poorly to moderately indurated mudstone
65						grades to greenish-grey mudstone @ 90'
70						grades back to sandstone @ 96'
75						
80						
85						
90						
95						
100						TD @ 100'; NFW

**VECTOR**  
ENGINEERING, INC.  
1601 Fairview Avenue, Ste H  
Carson City, NV. 89701  
(702) 883-7065

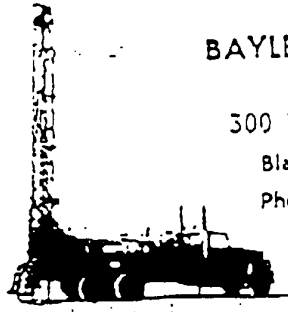
PROJECT	SAN JUAN COUNTY	DRILLING COMPANY	PC EXPLORATION
LOCATION	WHITE MESA SANITARY LANDFILL	HAMMER DATA	140 lbs.
JOB NUMBER	975031.00	DATE DRILLED	9/24/97
LOGGED BY	RBB	TOTAL DEPTH OF HOLE	100'
DRILL RIG	REVERSE CIRCULATION	WATER ENCOUNTERED	NFW



LOG OF BORING						DH-3	
MATERIALS DESCRIPTION						PAGE 1 OF 1	
DEPTH (feet)	STATIC WATER LEVEL	BLOW COUNTS PER SIX-INCH INTERVAL	SAMPLE TYPE	USCS SOIL CLASS	GRAPHIC LOG		
5						Silty SAND (SM), reddish-brown, slightly moist, loose to medium dense, very fine	
10							
15							
20						MUDSTONE, reddish-brown to brown, slightly moist, with occasional zones of increased sand content, varying degrees of induration	
25							
30		50-2'					
35							
40							
45						grades to greenish-grey @ 45', poorly indurated	
50						grades sandier @ 51'-52' and 57'-60' and well indurated, softer from 52'-57' alternating poorly and well indurated mudstone with occasional sandy lenses to 69'	
55							
60							
65							
70						SANDSTONE - light yellowish-green, fine to very fine, moderately to well indurated, with occasional lenses of poorly to moderately indurated mudstone	
75							
80							
85							
90							
95						with lenses of dark green to brown mudstone @ 95'-100', lenses are poorly to moderately indurated	
100						TD @ 100'; NFWE	

**VECTOR**  
ENGINEERING, INC.  
1601 Fairview Avenue, Ste H  
Carson City, NV. 89701  
(702) 883-7065

PROJECT	SAN JUAN COUNTY	DRILLING COMPANY	PC EXPLORATION
LOCATION	WHITE MESA SANITARY LANDFILL	HAMMER DATA	140 lbs.
JOB NUMBER	975031.00	DATE DRILLED	9/24/97
LOGGED BY	RBB	TOTAL DEPTH OF HOLE	100'
DRILL RIG	REVERSE CIRCULATION	WATER ENCOUNTERED	NFWE



## BAYLES EXPLORATION

RANDY L. BAYLES

300 W. Center - 47-6

Blanding, Utah 84511

Phone (801) 678-2434

February 03, 1993

Bryan Bremner  
P.O. Box 59  
Panquitch, Utah 84759

09-26-93

Hole # B3#4 Reference map for location

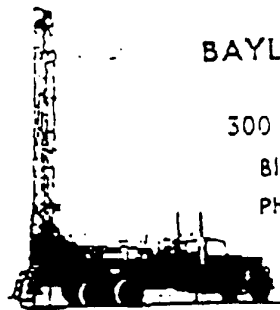
Formation Tests for permeability - 5 1/8 inch deameter hole by  
200 feet deep

0 -	25 =	0 GPM
25 -	50 =	1 GPM
50 -	75 =	1/2 GPM
75 -	100 =	1/2 GPM
100 -	125 =	3 GPM
125 -	150 =	4 GPM
150 -	175 =	0 GPM
175 -	200 =	4 GPM

% Breakdown between sandstone (ss)  
Shales Clay (cl)

0 -	10 =	20% Topsoil	60% ss	20% cl
10 -	20 =		80% ss	20% cl
20 -	30 =		80% ss	20% cl
30 -	40 =		65% ss	35% cl
40 -	50 =		75% ss	25% cl
50 -	60 =		50% ss	50% cl
60 -	70 =		50% ss	50% cl
70 -	80 =		40% ss	60% cl
80 -	90 =		10% ss	90% cl
90 -	100 =		10% ss	90% cl
100 -	110 =		40% ss	60% cl
110 -	120 =		90% ss	10% cl
120 -	130 =		90% ss	10% cl
130 -	140 =		95% ss	05% cl
140 -	150 =		15% ss	85% cl
150 -	160 =		50% ss	70% cl
160 -	170 =		05% ss	95% cl
170 -	180 =		20% ss	80% cl
180 -	190 =		85% ss	15% cl
190 -	200 =		80% ss	20% cl

Exhibit #10a Drill Logs and Information



# BAYLES EXPLORATION

RANDEE L. BAYLES

300 W. Center - 47-6

Blanding, Utah 84511

Phone (801) 678-2434

09-29-93

Hole # BR#3 Reference map for location

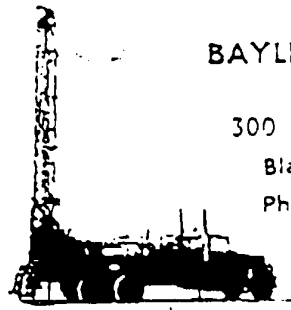
Formation Tests for Permeability 5 1/8 inch diameter hole by  
200 feet deep

0 -	25 = 0 GPM
25 -	50 = 6 GPM
50 -	75 = 1/2 GPM
75 -	100 = 3 GPM
100 -	125 = 1 1/2 GPM
125 -	150 = 2 GPM
150 -	175 = 1 GPM
175 -	200 = 0 GPM

% Breaksown between Sandstones (ss) and Shales Clays (cl)

0 -	10 =	50% Topsoil	50% cl
10 -	20 =	50% ss	50% cl
20 -	30 =	80% ss	20% cl
30 -	40 =	95% ss	05% cl
40 -	50 =	85% ss	15% cl
50 -	60 =	70% ss	30% cl
60 -	70 =	20% ss	80% cl
70 -	80 =	05% ss	95% cl
80 -	90 =	20% ss	80% cl
90 -	100 =	90% ss	10% cl
100 -	110 =	90% ss	10% cl
110 -	120 =	85% ss	15% cl
120 -	130 =	60% ss	40% cl
130 -	140 =	30% ss	70% cl
140 -	150 =	100% ss	0% cl
150 -	160 =	100% ss	0% cl
160 -	170 =	90% ss	10% cl
170 -	180 =	25% ss	75% cl
180 -	190 =	80% ss	20% cl
190 -	200 =	90% ss	10% cl

Exhibit #10b Drill Logs and Information



## BAYLES EXPLORATION

RANDEE L. BAYLES

300 W. Center 47-6

Blanding, Utah 84511

Phone (501) 678-2434

09-27-93

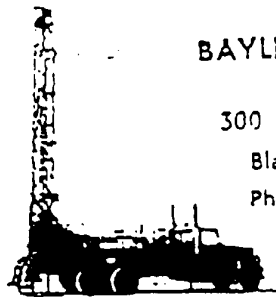
Hole # BB#2 Reference map for location

Formation Tests for permeability - 5 1/8 inch diameter hole by  
200 feet deep

0 -	25 =	0 GPM
25 -	50 =	2 1/2 GPM
50 -	75 =	0 GPM
75 -	100 =	47 GPM
100 -	125 =	9 GPM
125 -	150 =	17 GPM
150 -	175 =	11 GPM
175 -	200 =	8 GPM

% Breakdown between Sandstones (ss and Shales Clays (cl))

0 -	10 =	10% Top Soil	90% cl
10 -	20 =	10% ss	90% cl
20 -	30 =	10% ss	90% cl
30 -	40 =	50% ss	50% cl
40 -	50 =	60% ss	40% cl
50 -	60 =	40% ss	60% cl
60 -	70 =	30% ss	70% cl
70 -	80 =	10% ss	90% cl
80 -	90 =	95% ss	05% cl
90 -	100 =	100% ss	0% cl
100 -	110 =	100% ss	0% cl
110 -	120 =	85% ss	15% cl
120 -	130 =	80% ss	20% cl
130 -	140 =	75% ss	25% cl
140 -	150 =	100% ss	0% cl
150 -	160 =	90% ss	10% cl
160 -	170 =	70% ss	30% cl
170 -	180 =	100% ss	0% cl
180 -	190 =	80% ss	20% cl
190 -	200 =	85% ss	15% cl



## BAYLES EXPLORATION

RANDOLPH L. BAYLES

300 W. Center - 47-6

Blanding, Utah 84511

Phone (801) 678-2434

09-28-93

Hole # BB #1 Reference map for location

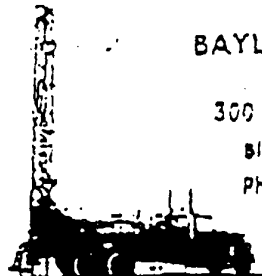
Formation Tests for Permeability - 5 1/8 inch diameter  
hole by 200 feet deep

0 -	25 =	0 GPM
25 -	50 =	13 GPM
50 -	75 =	8 GPM
75 -	100 =	3 1/2 GPM
100 -	125 =	4 GPM
125 -	150 =	7 GPM
150 -	175 =	2 GPM
175 -	200 =	5 GPM

% Breakdown between Sandstones (ss) and Shales Clays (cl)

0 -	10 =	10% ss	90% cl
10 -	20 =	20% ss	80% cl
20 -	30 =	50% ss	50% cl
30 -	40 =	100% ss	0% cl
40 -	50 =	75% ss	25% cl
50 -	60 =	60% ss	40% cl
60 -	70 =	90% ss	10% cl
70 -	80 =	60% ss	40% cl
80 -	90 =	50% ss	50% cl
90 -	100 =	55% ss	65% cl
100 -	110 =	85% ss	15% cl
110 -	120 =	70% ss	30% cl
120 -	130 =	70% ss	30% cl
130 -	140 =	80% ss	20% cl
140 -	150 =	95% ss	05% cl
150 -	160 =	100% ss	0% cl
160 -	170 =	75% ss	25% cl
170 -	180 =	85% ss	15% cl
180 -	190 =	80% ss	20% cl
190 -	200 =	80% ss	20% cl

Exhibit #106 Drill Logs and Information



# BAYLES EXPLORATION

CANDICE L. BAYLES

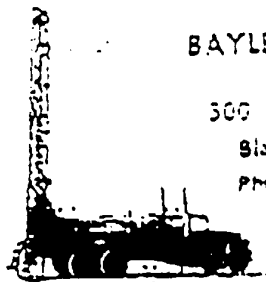
300 W. Center - 47-6

Blanding, Utah 84511

Phone (801) 676-2434

## % Breakdown between sandstone (ss) and Shales Clay (cl)

0 - 10 = 20% Top Soil	10% ss	70 cl	
10 - 20	20% ss	80 cl	
20 - 30	15% ss	85 cl	
30 - 40	65% ss	35 cl	
40 - 50	70% ss	30 cl	
50 - 60	35% ss	65 cl	
60 - 70	30% ss	70 cl	
70 - 80	10% ss	90 cl	
80 - 90	90 ss	10 cl	
90 - 100	90 ss	10 cl	
100 - 110	90 ss	10 cl	
110 - 120	80 ss	20 cl	
120 - 130	75 ss	25 cl	
130 - 140	70 ss	30 cl	
140 - 150	90 ss	10 cl	
150 - 160	90 ss	10 cl	
160 - 170	70 ss	30 cl	
170 - 180	90 ss	10 cl	
180 - 190	75 ss	25 cl	
190 - 200	80 ss	20 cl	
200 - 210	90 ss	10 cl	
210 - 220	90 ss	10 cl	
220 - 230	75 ss	25 cl	
230 - 240	80 ss	20 cl	
240 - 250	40 ss	60 cl	
250 - 260	50 ss	50 cl	
260 - 270	65 ss	35 cl	
270 - 280	70 ss	30 cl	
280 - 290	30 ss	70 cl	
290 - 300	10 ss	90 cl	
300 - 310	10 ss	90 cl	
310 - 320	10 ss	90 cl	
320 - 330	0 ss	100 cl	
330 - 340	90 ss	10 cl	Wet Sand
340 - 350	10 ss	90 cl	
350 - 360	0 ss	100 cl	
360 - 370	0 ss	100 cl	
370 - 380	10 ss	90 cl	
380 - 390	20 ss	80 cl	
390 - 400	15 ss	85 cl	
400 - 410	25 ss	75 cl	
410 - 420	10 ss	90 cl	
420 - 430	30 ss	70 cl	
430 - 440	75 ss	25 cl	
440 - 450	70 ss	30 cl	



# BAYLES EXPLORATION

KARDEL L. BAYLES

500 W. Center 47-6

Blanding, Utah 84511

Phone (801) 678-2404

450 - 460	60 ss	40 cl	
460 - 470	75 ss	25 cl	
470 - 480	100 ss	0 cl	
480 - 490	65 ss	35 cl	
490 - 500	45 ss	55 cl	
500 - 510	50 ss	50 cl	
510 - 520	30 ss	70 cl	
520 - 530	25 ss	75 cl	
530 - 540	60 ss	40 cl	
540 - 550	75 ss	25 cl	
550 - 560	80 ss	20 cl	
560 - 570	65 ss	35 cl	
570 - 580	40 ss	60 cl	
580 - 590	40 ss	60 cl	
590 - 600	55 ss	45 cl	
600 - 610	80 ss	20 cl	
610 - 620	90 ss	10 cl	
620 - 630	100 ss	0 cl	
630 - 640	100 ss	0 cl	
640 - 650	90 ss	10 cl	
650 - 660	90 ss	10 cl	
660 - 670	80 ss	20 cl	
670 - 680	100 ss	0 cl	(increasing water)
680 - 690	65 ss	35 cl	
690 - 700	70 ss	30 cl	
700 - 710	80 ss	20 cl	
710 - 720	60 ss	40 cl	
720 - 730	45 ss	55 cl	
730 - 740	60 ss	40 cl	
740 - 750	60 ss	20 cl	
750 - 760	80 ss	20 cl	
760 - 770	90 ss	10 cl	
770 - 780	100 ss	0 cl	(30 GPH)

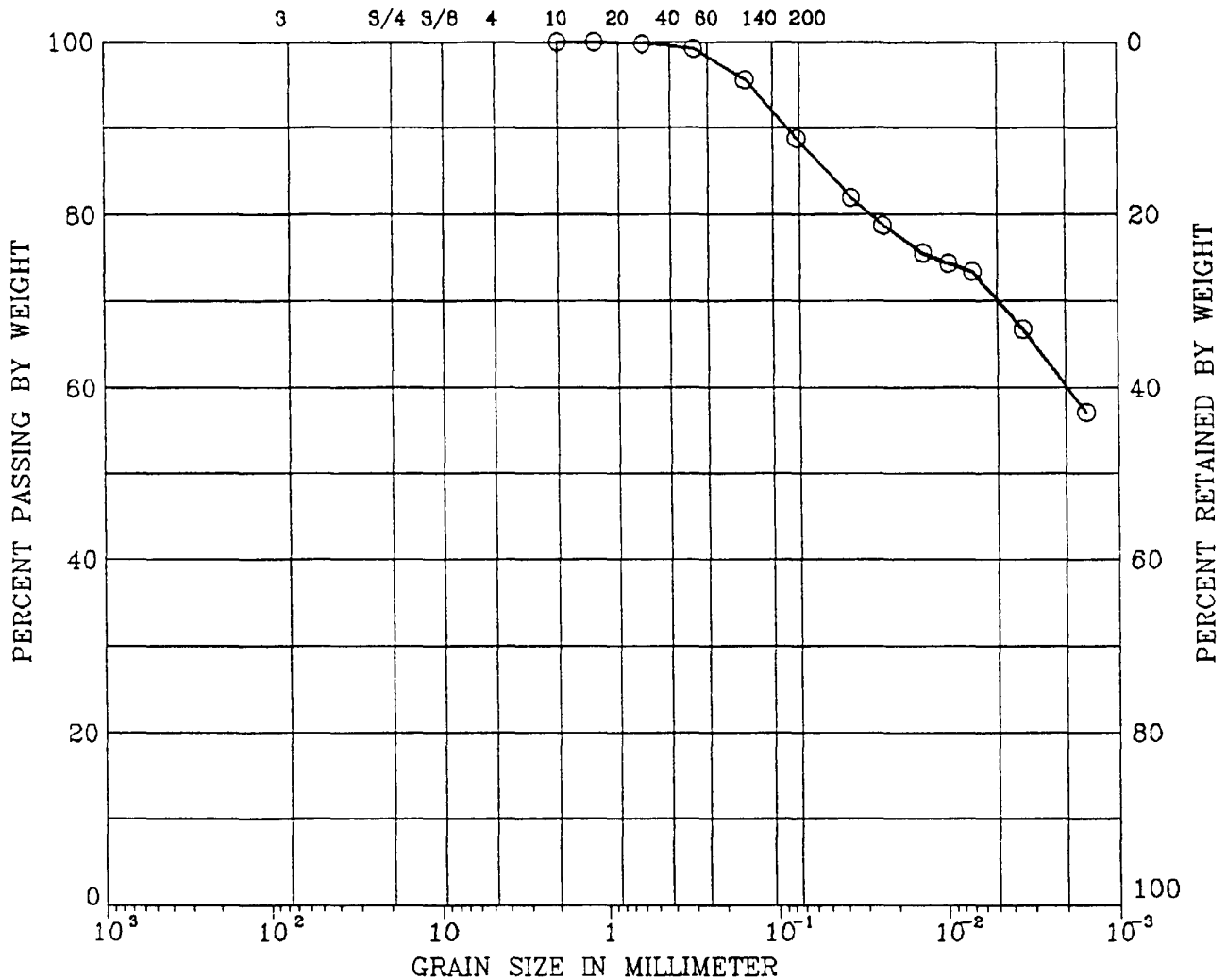
**APPENDIX B**  
**Results of Laboratory Analyses**

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# UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	DH-2	10-10.5	130	97	Light Gray Fat Clay (CH)

Remark :

Proj. No.975031.00

SAN JUAN COUNTY

Vector  
Engineering

GRAIN SIZE DISTRIBUTION Lab File 689A

Client Name: Vector Engineering

Project No. 975031.00

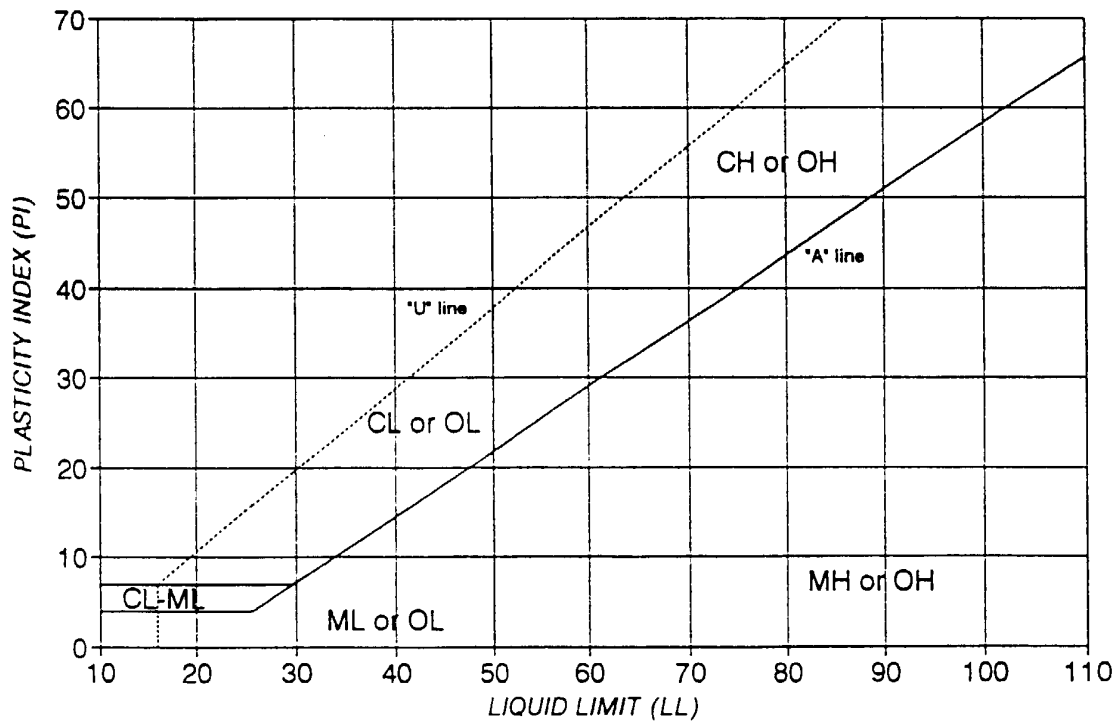
Project Name: San Juan County

Date: 12/09/97

Lab Log: 689

TEST NO.	SAMPLE I.D.	DEPTH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	CLASSIFICATION
1.	DH-2	10.0-10.5'	130	33	97	Light Gray Fat Clay (CH)
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**PLASTICITY CHART**



TESTS PERFORMED IN GENERAL ACCORDANCE WITH ASTM D-4318, METHOD B.

12438 Loma Rica Dr., Suite C, Grass Valley, CA 95945

(916) 272-2448 Fax: (916) 272-8553

## PERMEABILITY TEST SUMMARY

**Client:** VECTOR - CARSON CITY

**Project No.: 975031.00-689**

**Project: SAN JUAN COUNTY**

**Test Type:** ASTM D-5084C

**Date:** Oct. 18, 1997

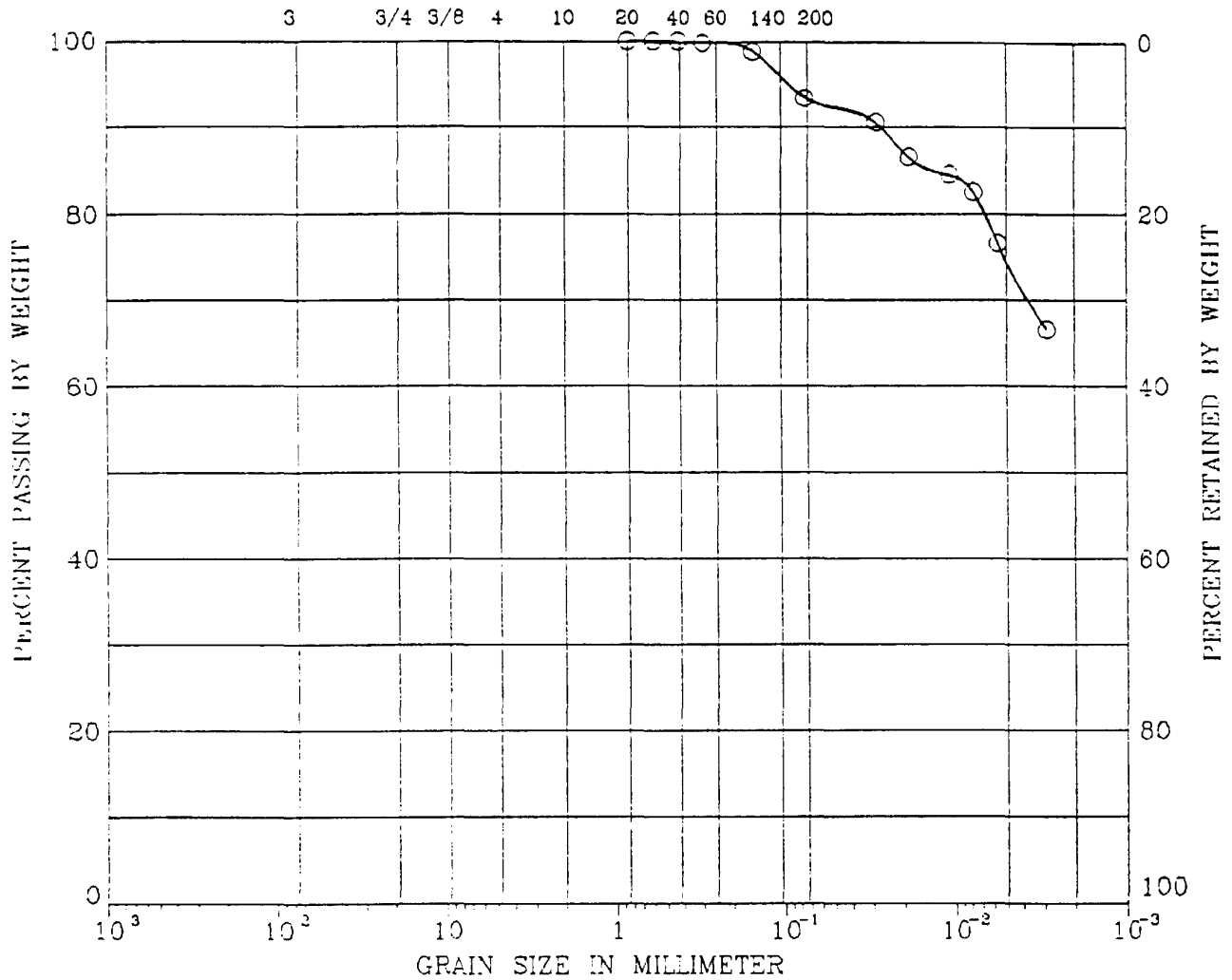
Sample Identification:	DH-2 10.0-10.5'				
INITIAL:					
Moisture Content (%):	19.0				
Dry Density (pcf):	106				
Saturation (%):	86				
Porosity (%):	37.4				
Void Ratio:	0.598				
FINAL:					
Moisture Content (%):	29.7				
Dry Density (pcf):	94				
Saturation (%):	100				
Porosity (%):	44.5				
Void Ratio:	0.802				
TEST RESULTS:					
"B" Parameter:					
Hydraulic Conductivity (cm/sec):	5.3E-08				
Effective Consolidation Pressure (psi):	10				
Gradient Range:	6-7				
Notes:					

NOTES: De-aired tap water was used as permeant.  
The above Saturation, Porosity and Void Ratio are based upon an assumed Specific Gravity of 2.70.

Reviewed By:

# UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. Sieve Size in Inches			U.S. Standard Sieve No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
C	1	no	136	101	grayish-brown inorganic clay (CH)

Remark : Sample from NEC Excavation

Job No. 975031.00

San Juan County

Vector  
Engineering

GRAIN SIZE DISTRIBUTION

Lab No. 57-67

**APPENDIX C**  
**Default Soil, Waste, and Geosynthetic Characteristics**

---

TABLE 4. DEFAULT SOIL, WASTE, AND GEOSYNTHETIC CHARACTERISTICS

Classification			Total Porosity	Field Capacity	Wilting Point	Saturated Hydraulic Conductivity
HELP	USDA	USCS	vol/vol	vol/vol	vol/vol	cm/sec
1	CoS	SP	0.417	0.045	0.018	$1.0 \times 10^{-2}$
2	S	SW	0.437	0.062	0.024	$5.8 \times 10^{-4}$
3	FS	SW	0.457	0.083	0.033	$3.1 \times 10^{-4}$
4	LS	SM	0.437	0.105	0.047	$1.7 \times 10^{-4}$
5	LFS	SM	0.457	0.131	0.058	$1.0 \times 10^{-4}$
6	SL	SM	0.453	0.190	0.085	$7.2 \times 10^{-5}$
7	FSL	SM	0.473	0.222	0.104	$5.2 \times 10^{-5}$
8	L	ML	0.463	0.232	0.116	$3.7 \times 10^{-5}$
9	SIL	ML	0.501	0.284	0.135	$1.9 \times 10^{-5}$
10	SCL	SC	0.398	0.244	0.136	$1.2 \times 10^{-5}$
11	CL	CL	0.464	0.310	0.187	$6.4 \times 10^{-3}$
12	SiCL	CL	0.471	0.342	0.210	$4.2 \times 10^{-3}$
13	SC	SC	0.430	0.321	0.221	$3.3 \times 10^{-3}$
14	SiC	CH	0.479	0.371	0.251	$2.5 \times 10^{-3}$
15	C	CH	0.475	0.378	0.265	$1.7 \times 10^{-3}$
16	Barrier Soil		0.427	0.413	0.367	$1.0 \times 10^{-3}$
17	Bentonite Mat (0.6 cm)		0.750	0.747	0.400	$3.0 \times 10^{-4}$
18	Municipal Waste (900 lb/yrd <sup>3</sup> or 312 kg/m <sup>3</sup> )		0.671	0.292	0.077	$1.0 \times 10^{-3}$
19	Municipal Waste (channeling and dead zones)		0.168	0.073	0.019	$1.0 \times 10^{-3}$
20	Drainage Net (0.5 cm)		0.850	0.010	0.005	$1.0 \times 10^{-1}$
21	Gravel		0.397	0.032	0.013	$3.0 \times 10^{-1}$
22	L*	ML	0.419	0.307	0.180	$1.9 \times 10^{-3}$
23	SIL*	ML	0.461	0.360	0.203	$9.0 \times 10^{-4}$
24	SCL*	SC	0.365	0.305	0.202	$2.7 \times 10^{-4}$
25	CL*	CL	0.437	0.373	0.266	$3.6 \times 10^{-4}$
26	SiCL*	CL	0.445	0.393	0.277	$1.9 \times 10^{-4}$
27	SC*	SC	0.400	0.366	0.288	$7.8 \times 10^{-5}$
28	SiC*	CH	0.452	0.411	0.311	$1.2 \times 10^{-4}$
29	C*	CH	0.451	0.419	0.332	$6.8 \times 10^{-5}$
30	Coal-Burning Electric Plant Fly Ash*		0.541	0.187	0.047	$5.0 \times 10^{-3}$
31	Coal-Burning Electric Plant Bottom Ash*		0.578	0.076	0.025	$4.1 \times 10^{-3}$
32	Municipal Incinerator Fly Ash*		0.450	0.116	0.049	$1.0 \times 10^{-3}$
33	Fine Copper Slag*		0.375	0.055	0.020	$4.1 \times 10^{-3}$
34	Drainage Net (0.5 cm)		0.850	0.010	0.005	$3.3 \times 10^{-1}$

\* Moderately Compacted

(Continued)

TABLE 4 (continued). DEFAULT SOIL, WASTE, AND GEOSYNTHETIC CHARACTERISTICS

Classification		Total Porosity	Field Capacity	Wilting Point	Saturated Hydraulic Conductivity
HELP	Geomembrane Material	vol/vol	vol/vol	vol/vol	cm/sec
35	High Density Polyethylene (HDPE)				$2.0 \times 10^{-15}$
36	Low Density Polyethylene (LDPE)				$4.0 \times 10^{-13}$
37	Polyvinyl Chloride (PVC)				$2.0 \times 10^{-11}$
38	Butyl Rubber				$1.0 \times 10^{-12}$
39	Chlorinated Polyethylene (CPE)				$4.0 \times 10^{-12}$
40	Hypalon or Chlorosulfonated Polyethylene (CSPE)				$3.0 \times 10^{-12}$
41	Ethylene-Propylene Diene Monomer (EPDM)				$2.0 \times 10^{-12}$
42	Neoprene				$3.0 \times 10^{-12}$

(concluded)

**APPENDIX D**  
**Output Files from HELP Model Simulations**



**HELP3 Model Output:**  
**OUTDRY.OUT**

```
*****
**
**
**      HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
**      HELP MODEL VERSION 3.06 (17 AUGUST 1996)
**      DEVELOPED BY ENVIRONMENTAL LABORATORY
**      USAE WATERWAYS EXPERIMENT STATION
**      FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
**
**
*****
```

PRECIPITATION DATA FILE: N:\975031\precip.D4  
TEMPERATURE DATA FILE: N:\975031\temp.D7  
SOLAR RADIATION DATA FILE: N:\975031\solar.D13  
EVAPOTRANSPIRATION DATA: N:\975031\evap.D11  
SOIL AND DESIGN DATA FILE: N:\975031\SOILDY.D10  
OUTPUT DATA FILE: N:\975031\OUTDRY.OUT

TIME: 16:49 DATE: 11/10/1997

```
*****
TITLE: San Juan County Landfill
*****
```

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER  
WERE SPECIFIED BY THE USER.

LAYER 1  
-----

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 6

THICKNESS = 12.00 INCHES  
POROSITY = 0.4530 VOL/VOL  
FIELD CAPACITY = 0.1900 VOL/VOL  
WILTING POINT = 0.0850 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1110 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 2  
-----

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

THICKNESS = 36.00 INCHES  
POROSITY = 0.6710 VOL/VOL  
FIELD CAPACITY = 0.2920 VOL/VOL  
WILTING POINT = 0.0770 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1200 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 3  
-----

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 6

THICKNESS = 12.00 INCHES  
POROSITY = 0.4530 VOL/VOL  
FIELD CAPACITY = 0.1900 VOL/VOL  
WILTING POINT = 0.0850 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1110 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

POROSITY = 0.4530 VOL/VOL  
FIELD CAPACITY = 0.1900 VOL/VOL  
WILTING POINT = 0.0850 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1110 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 10  
-----

TYPE I - VERTICAL PERCOLATION LAYER  
MATERIAL TEXTURE NUMBER 18  
THICKNESS = 36.00 INCHES  
POROSITY = 0.6710 VOL/VOL  
FIELD CAPACITY = 0.2920 VOL/VOL  
WILTING POINT = 0.0770 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1200 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 11  
-----

TYPE I - VERTICAL PERCOLATION LAYER  
MATERIAL TEXTURE NUMBER 6  
THICKNESS = 12.00 INCHES  
POROSITY = 0.4530 VOL/VOL  
FIELD CAPACITY = 0.1900 VOL/VOL  
WILTING POINT = 0.0850 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1110 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 12  
-----

TYPE I - VERTICAL PERCOLATION LAYER  
MATERIAL TEXTURE NUMBER 18  
THICKNESS = 36.00 INCHES  
POROSITY = 0.6710 VOL/VOL  
FIELD CAPACITY = 0.2920 VOL/VOL  
WILTING POINT = 0.0770 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1200 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 13  
-----

TYPE I - VERTICAL PERCOLATION LAYER  
MATERIAL TEXTURE NUMBER 6  
THICKNESS = 12.00 INCHES  
POROSITY = 0.4530 VOL/VOL  
FIELD CAPACITY = 0.1900 VOL/VOL  
WILTING POINT = 0.0850 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1110 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 14  
-----

TYPE I - VERTICAL PERCOLATION LAYER  
MATERIAL TEXTURE NUMBER 18  
THICKNESS = 36.00 INCHES  
POROSITY = 0.6710 VOL/VOL  
FIELD CAPACITY = 0.2920 VOL/VOL  
WILTING POINT = 0.0770 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1200 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

POROSITY = 0.6710 VOL/VOL  
FIELD CAPACITY = 0.2920 VOL/VOL  
WILTING POINT = 0.0770 VOL/VOL  
INITIAL SOIL WATER CONTENT = 0.1200 VOL/VOL  
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT  
SOIL DATA BASE USING SOIL TEXTURE # 6 WITH BARE  
GROUND CONDITIONS, A SURFACE SLOPE OF 3.% AND  
A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER = 85.90  
FRACTION OF AREA ALLOWING RUNOFF = 0.0 PERCENT  
AREA PROJECTED ON HORIZONTAL PLANE = 20.000 ACRES  
EVAPORATIVE ZONE DEPTH = 16.0 INCHES  
INITIAL WATER IN EVAPORATIVE ZONE = 1.812 INCHES  
UPPER LIMIT OF EVAPORATIVE STORAGE = 8.120 INCHES  
LOWER LIMIT OF EVAPORATIVE STORAGE = 1.328 INCHES  
INITIAL SNOW WATER = 0.000 INCHES  
INITIAL WATER IN LAYER MATERIALS = 56.520 INCHES  
TOTAL INITIAL WATER = 56.520 INCHES  
TOTAL SUBSURFACE INFLOW = 0.00 INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM  
MILFORD UTAH

STATION LATITUDE = 37.27 DEGREES  
MAXIMUM LEAF AREA INDEX = 0.00  
START OF GROWING SEASON (JULIAN DATE) = 126  
END OF GROWING SEASON (JULIAN DATE) = 282  
EVAPORATIVE ZONE DEPTH = 16.0 INCHES  
AVERAGE ANNUAL WIND SPEED = 8.80 MPH  
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %  
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 36.00 %  
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 34.00 %  
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 58.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR MILFORD UTAH

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
0.97	0.79	0.81	0.61	0.51	0.34
1.11	1.13	1.01	1.21	0.93	0.97

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR MILFORD UTAH

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
28.00	35.30	42.40	50.50	59.70	69.00
75.50	73.10	64.60	52.60	40.00	30.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR MILFORD UTAH  
AND STATION LATITUDE = 37.27 DEGREES

RUNOFF	0.000	0.0000	
PERCOLATION/LEAKAGE THROUGH LAYER 20	0.000025	1.80959	
SNOW WATER	3.21	232828.1090	
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3582	
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0830	

.....  
.....  
FINAL WATER STORAGE AT END OF YEAR 80

LAYER	(INCHES)	(VOL/VOL)
1	2.2626	0.1886
2	9.2835	0.2579
3	2.1398	0.1783
4	9.1073	0.2530
5	2.0962	0.1747
6	9.0861	0.2524
7	2.0936	0.1745
8	9.0843	0.2523
9	2.0937	0.1745
10	9.0817	0.2523
11	2.0933	0.1744
12	8.1018	0.2250
13	1.9572	0.1631
14	4.7919	0.1331
15	1.3634	0.1136
16	4.3202	0.1200
17	1.3474	0.1123
18	4.3200	0.1200
19	1.3473	0.1123
20	4.2669	0.1185
SNOW WATER	0.431	

  
.....  
.....

**HELP3 Model Output:**  
**LINED.OUT**

HMF 1655 DATT 11 10 1997

.....  
 TITLE San Juan County Landfill  
 .....

NOTE. INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE SPECIFIED BY THE USER.

LAYER 1  
-----

TYPE 1 - VERTICAL PERCOLATION LAYER	
MATERIAL TEXTURE NUMBER 6	
THICKNESS	13.33 INCHES
POROSITY	0.4530 VOL. VOL.
FIELD CAPACITY	0.1900 VOL. VOL.
WILTING POINT	0.0850 VOL. VOL.
INITIAL SOIL WATER CONTENT	0.1140 VOL. VOL.
EFFECTIVE SAT. HYD. COND.	0.720000001000E-03 CM/SEC.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER	
MATERIAL TEXTURE NUMBER 18	
THICKNESS	40.00 INCHES
POROSITY	0.6710 VOL/VOL
FIELD CAPACITY	0.2920 VOL/VOL
WILTING POINT	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	0.2000 VOL/VOL
EFFECTIVE SAL. HYD COND	0.100000005000E-02 CM/SEC

## L. NYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER  
MATERIAL TEXTURE NUMBER 6  
THICKNESS 13.33 INCHES  
POROSITY 0.4530 VOL/VOL  
FIELD CAPACITY 0.1900 VOL/VOL  
WILTING POINT 0.0850 VOL/VOL  
INITIAL SOIL WATER CONTENT 0.1110 VOL/VOL  
EFFECTIVE SATURATED COND 0.720000011000E-03 CM/SEC

POROSITY 0.4530 VOL/VOL  
 FIELD CAPACITY 0.1900 VOL/VOL  
 WILTING POINT 0.0850 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.1110 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.720000011000E-03 CM/SEC

## LAYER 10

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

## MATERIAL TEXTURE NUMBER 18

THICKNESS 40.00 INCHES  
 POROSITY 0.6710 VOL/VOL  
 FIELD CAPACITY 0.2920 VOL/VOL  
 WILTING POINT 0.0770 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.2000 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.100000005000E-02 CM/SEC

## LAYER 11

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

## MATERIAL TEXTURE NUMBER 6

THICKNESS 13.33 INCHES  
 POROSITY 0.4530 VOL/VOL  
 FIELD CAPACITY 0.1900 VOL/VOL  
 WILTING POINT 0.0850 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.1110 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.720000011000E-03 CM/SEC

## LAYER 12

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

## MATERIAL TEXTURE NUMBER 18

THICKNESS 40.00 INCHES  
 POROSITY 0.6710 VOL/VOL  
 FIELD CAPACITY 0.2920 VOL/VOL  
 WILTING POINT 0.0770 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.2000 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.100000005000E-02 CM/SEC

## LAYER 13

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

## MATERIAL TEXTURE NUMBER 6

THICKNESS 13.33 INCHES  
 POROSITY 0.4530 VOL/VOL  
 FIELD CAPACITY 0.1900 VOL/VOL  
 WILTING POINT 0.0850 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.1110 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.720000011000E-03 CM/SEC

## LAYER 14

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

## MATERIAL TEXTURE NUMBER 18

THICKNESS 40.00 INCHES  
 POROSITY 0.6710 VOL/VOL  
 FIELD CAPACITY 0.2920 VOL/VOL  
 WILTING POINT 0.0770 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.2000 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.100000005000E-02 CM/SEC



A SLOPE LENGTH OF 300 FEET

SCS RUNOFF CURVE NUMBER = 85.90  
 FRACTION OF AREA ALLOWING RUNOFF = 0.0 PERCENT  
 AREA PROJECTED ON HORIZONTAL PLANE = 20.000 ACRES  
 EVAPORATIVE ZONE DEPTH = 16.0 INCHES  
 INITIAL WATER IN EVAPORATIVE ZONE = 2.014 INCHES  
 UPPER LIMIT OF EVAPORATIVE STORAGE = 7.830 INCHES  
 LOWER LIMIT OF EVAPORATIVE STORAGE = 1.339 INCHES  
 INITIAL SNOW WATER = 0.000 INCHES  
 INITIAL WATER IN LAYER MATERIALS = 90.441 INCHES  
 TOTAL INITIAL WATER = 90.441 INCHES  
 TOTAL SUBSURFACE INFLOW = 0.00 INCHES YEAR

## EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM  
 MILFORD UTAH

STATION LATITUDE 37.27 DEGREES  
 MAXIMUM LEAF AREA INDEX 0.00  
 START OF GROWING SEASON (JULIAN DATE) = 126  
 END OF GROWING SEASON (JULIAN DATE) = 282  
 EVAPORATIVE ZONE DEPTH = 16.0 INCHES  
 AVERAGE ANNUAL WIND SPEED = 8.80 MPH  
 AVERAGE 1ST QUARTER RELATIVE HUMIDITY 64.00 %  
 AVERAGE 2ND QUARTER RELATIVE HUMIDITY 36.00 %  
 AVERAGE 3RD QUARTER RELATIVE HUMIDITY 34.00 %  
 AVERAGE 4TH QUARTER RELATIVE HUMIDITY 58.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING  
 COEFFICIENTS FOR MILFORD UTAH

## NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN-JUL	FEB-AUG	MAR-SEP	APR-OCT	MAY-NOV	JUN-DEC
0.97	0.79	0.81	0.61	0.51	0.34
1.11	1.13	1.01	1.21	0.93	0.97

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING  
 COEFFICIENTS FOR MILFORD UTAH

## NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN-JUL	FEB-AUG	MAR-SEP	APR-OCT	MAY-NOV	JUN-DEC
28.00	35.30	42.40	50.50	59.70	69.00
75.50	73.10	64.60	52.60	40.00	30.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING  
 COEFFICIENTS FOR MILFORD UTAH  
 AND STATION LATITUDE 37.27 DEGREES

## AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 80

JAN-JUL	FEB-AUG	MAR-SEP	APR-OCT	MAY-NOV	JUN-DEC
0.95	0.78	0.82	0.65	0.54	0.33
1.15	1.04	1.07	1.37	1.14	1.11

(INCHES) (CU. FT.)

PRECIPITATION	2.11	153186.000
RUNOFF	0.000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 19	0.000000	0.00000
AVERAGE HEAD ON TOP OF LAYER 19	0.000	
SNOW WATER	3.21	232828.1090
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3571
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0837

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FINAL WATER STORAGE AT END OF YEAR 80

LAYER	(INCHES)	(VOL/VOL)
1	2.5443	0.1909
2	11.1990	0.2800
3	2.4915	0.1869
4	11.0991	0.2775
5	2.4583	0.1844
6	11.0803	0.2770
7	2.4558	0.1842
8	11.0790	0.2770
9	2.4554	0.1842
10	11.0783	0.2770
11	2.4556	0.1842
12	11.0785	0.2770
13	2.4554	0.1842
14	11.0787	0.2770
15	2.4554	0.1842
16	11.0789	0.2770
17	2.4554	0.1842
18	11.0792	0.2770
19	5.1240	0.4270
SNOW WATER	0.431	

**HELP3 Model Output:**  
**RESULTS.OUT**

Vector Engineering, Inc.  
(in 275031.00 results.doc)

POROSITY 0.4530 VOL/VOL  
 FIELD CAPACITY 0.1900 VOL/VOL  
 WILTING POINT 0.0850 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.1110 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.720000011000E-03 CM/SEC

## LAYER 10

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

THICKNESS 36.00 INCHES  
 POROSITY 0.6710 VOL/VOL  
 FIELD CAPACITY 0.2920 VOL/VOL  
 WILTING POINT 0.0770 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.2000 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.100000005000E-02 CM/SEC

## LAYER 11

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 6

THICKNESS 12.00 INCHES  
 POROSITY 0.4530 VOL/VOL  
 FIELD CAPACITY 0.1900 VOL/VOL  
 WILTING POINT 0.0850 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.1110 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.720000011000E-03 CM/SEC

## LAYER 12

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

THICKNESS 36.00 INCHES  
 POROSITY 0.6710 VOL/VOL  
 FIELD CAPACITY 0.2920 VOL/VOL  
 WILTING POINT 0.0770 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.2000 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.100000005000E-02 CM/SEC

## LAYER 13

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 6

THICKNESS 12.00 INCHES  
 POROSITY 0.4530 VOL/VOL  
 FIELD CAPACITY 0.1900 VOL/VOL  
 WILTING POINT 0.0850 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.1110 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.720000011000E-03 CM/SEC

## LAYER 14

-----

## TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

THICKNESS 36.00 INCHES  
 POROSITY 0.6710 VOL/VOL  
 FIELD CAPACITY 0.2920 VOL/VOL  
 WILTING POINT 0.0770 VOL/VOL  
 INITIAL SOIL WATER CONTENT 0.2000 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.100000005000E-02 CM/SEC

POROSITY 0.6710 VOL/VOL  
 FIELD CAPACITY 0.2920 VOL/VOL  
 WILTING POINT 0.0770 VOL/VOL  
 INITIAL SOIL WATER CONTENT = 0.2000 VOL/VOL  
 EFFECTIVE SAT. HYD. COND. 0.100000005000E-02 CM/SEC

#### GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT  
 SOIL DATA BASE USING SOIL TEXTURE # 6 WITH BARE  
 GROUND CONDITIONS, A SURFACE SLOPE OF 3.0% AND  
 A SLOPE LENGTH OF 300 FEET.

SCS RUNOFF CURVE NUMBER 85.90  
 FRACTION OF AREA ALLOWING RUNOFF 0.0 PERCENT  
 AREA PROJECTED ON HORIZONTAL PLANE = 20.000 ACRES  
 EVAPORATIVE ZONE DEPTH = 16.0 INCHES  
 INITIAL WATER IN EVAPORATIVE ZONE 2.132 INCHES  
 UPPER LIMIT OF EVAPORATIVE STORAGE 8.120 INCHES  
 LOWER LIMIT OF EVAPORATIVE STORAGE 1.328 INCHES  
 INITIAL SNOW WATER 0.000 INCHES  
 INITIAL WATER IN LAYER MATERIALS 85.320 INCHES  
 TOTAL INITIAL WATER 85.320 INCHES  
 TOTAL SUBSURFACE INFLOW 0.00 INCHES YEAR

#### EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM  
 MILFORD UTAH

STATION LATITUDE 37.27 DEGREES  
 MAXIMUM LEAF AREA INDEX 0.00  
 START OF GROWING SEASON (JULIAN DATE) 126  
 END OF GROWING SEASON (JULIAN DATE) 282  
 EVAPORATIVE ZONE DEPTH 16.0 INCHES  
 AVERAGE ANNUAL WIND SPEED 8.80 MPH  
 AVERAGE 1ST QUARTER RELATIVE HUMIDITY 64.00 %  
 AVERAGE 2ND QUARTER RELATIVE HUMIDITY 36.00 %  
 AVERAGE 3RD QUARTER RELATIVE HUMIDITY 34.00 %  
 AVERAGE 4TH QUARTER RELATIVE HUMIDITY 58.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING  
 COEFFICIENTS FOR MILFORD UTAH

#### NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN	JUL	FEB	AUG	MAR	SEP	APR	OCT	MAY	NOV	JUN	DEC
0.97	0.79	0.81	0.61	0.51	0.34	1.11	1.13	1.01	1.21	0.93	0.97

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING  
 COEFFICIENTS FOR MILFORD UTAH

#### NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN	JUL	FEB	AUG	MAR	SEP	APR	OCT	MAY	NOV	JUN	DEC
28.00	35.30	42.40	50.50	59.70	69.00	75.50	73.10	64.60	52.60	40.00	30.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING

PRECIPITATION	2.11	153186.000
RUNOFF	0.000	0.0000
PERCOLATION LEAKAGE THROUGH LAYER 20	0.002871	208.47064
SNOW WATER	3.21	232828.1090
MAXIMUM VEG. SOIL WATER (VOL. VOL.)		0.3582
MINIMUM VEG. SOIL WATER (VOL. VOL.)		0.0830

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FINAL WATER STORAGE AT END OF YEAR 80

LAYER	(INCHES)	(VOL. VOL.)
1	2.2619	0.1885
2	9.4474	0.2624
3	2.1642	0.1804
4	9.3135	0.2587
5	2.1245	0.1770
6	9.2944	0.2582
7	2.1211	0.1768
8	9.2923	0.2581
9	2.1219	0.1768
10	9.2914	0.2581
11	2.1209	0.1767
12	9.2879	0.2580
13	2.1218	0.1768
14	9.2876	0.2580
15	2.1204	0.1767
16	9.2872	0.2580
17	2.1203	0.1767
18	9.2844	0.2579
19	2.1196	0.1766
20	6.6999	0.1861
SNOW WATER	0.431	

**APPENDIX D**

**Addenda to Suspension Request**

---

Application for Renewal  
San Juan County Landfill





DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF SOLID AND HAZARDOUS WASTE

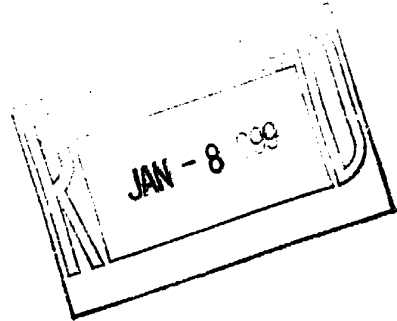
98.00999  
**FILE COPY**

Michael O. Leavitt  
Governor  
ne R. Nielson, Ph.D.  
Executive Director  
Dennis R. Downs  
Director

288 North 1460 West  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880  
(801) 538-6170  
(801) 538-6715 Fax  
(801) 536-4414 T.D.D.  
www.deq.state.ut.us Web

June 22, 1998

Rick Bailey, Administrative Assistant  
San Juan County Commission  
P.O. Box 9  
Monticello, Utah 84535



Re: Approval of the San Juan County Request of Suspension of Landfill Liner and Ground Water Monitoring Requirements

Dear Mr. Bailey:

The public comment period on the San Juan County's *Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill, San Juan County, Utah; Prepared by Vector Engineering, Inc.* (Request) ended June 12, 1998, with no comments being made. Accordingly, the Request is approved and thus the modification to the landfill permit is approved. A public notice of the approval will be published in the *San Juan Record*, the *Salt Lake Tribune*, and the *Deseret News* on Wednesday July 1, 1998.

The following documents need to be attached to your copies of the landfill permit that was issued on February 15, 1994.

- \* Document titled, *Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill, San Juan County, Utah; Prepared by Vector Engineering, Inc.*
- \* Letter dated February 26, 1998 from the Director of the Division of Solid & Hazardous Waste to you. The letter contained the *Request for Additional Information #1*.
- \* Letter dated April 2, 1998 from Vector Engineering to Jeff Emmons. The letter was the response to the *Request for Additional Information #1*.



DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF SOLID AND HAZARDOUS WASTE

98-00999  
**FILE COPY**

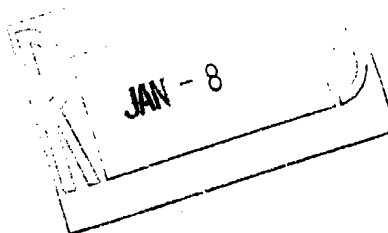
Michael O. Leavitt  
Governor  
Dennis R. Nielson, Ph.D.  
Executive Director

Dennis R. Downs  
Director

288 North 1460 West  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880  
(801) 538-6170  
(801) 538-6715 Fax  
(801) 536-4414 T.D.D.  
www.deq.state.ut.us Web

June 23, 1998

Newspaper Agency Corporation  
Legal Advertising Department  
Front Counter  
143 South Main Street  
Salt Lake City, Utah 84101



Dear Sir/Madam:

This letter constitutes authorization to publish the attached NOTICE in the *Salt Lake Tribune* and the *Deseret News* on Wednesday, July 1, 1998.

Please send invoice and affidavit of publication to:

Dennis R. Downs, Director  
Division of Solid and Hazardous Waste  
Utah Department of Environmental Quality  
PO Box 144880  
Salt Lake City, Utah 84114 - 4880

Sincerely,

Jeff Emmons, Environmental Scientist  
Solid Waste Section

JE/sm

Enclosure

c: David Cunningham, B.S.N., R.N., Health Off/Dept Dir, Southeast Utah Dist Health Dept  
David Ariotti, DEQ District Engineer

## NOTICE

San Juan County submitted a request to the Utah Division of Solid and Hazardous Waste, for an exemption from ground water monitoring and a bottom liner requirement at the San Juan County Landfill. The Division reviewed and released the request for public comment. The 30-day public comment period was announced in the *San Juan Record*, *Salt Lake Tribune* and *Deseret News* on May 13, 1998. No comments were received and approval of the request was granted on June 23, 1998.



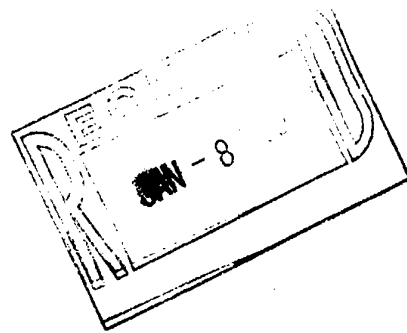
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DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF SOLID AND HAZARDOUS WASTE

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**FILE COPY**

Michael O. Leavitt  
Governor  
Dennis R. Nielson, Ph.D.  
Executive Director  
Dennis R. Downs  
Director

288 North 1460 West  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880  
(801) 538-6170 Voice  
(801) 538-6715 Fax  
(801) 536-4414 T.D.D.  
www.deq.state.ut.us Web

May 7, 1998



Newspaper Agency Corporation  
Legal Advertising Department  
Front Counter  
143 South Main  
Salt Lake City, UT 84101

Dear Sir/Madam:

This letter constitutes authorization to publish the attached NOTICE in the Salt Lake Tribune and Deseret News on Wednesday, May 13, 1998.

Please send invoice and affidavit of publication to:

Dennis R. Downs, Director  
Utah Department of Environmental Quality  
Division of Solid and Hazardous Waste  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880

Sincerely,

Jeff Emmons, Environmental Scientist  
Solid Waste Section

Enclosure

JE/sm

c: David Cunningham, B.S.N., R.N., Health Off/Dept Dir, Southeast Utah Dist Health Dept  
David Ariotti, DEQ District Engineer

## **NOTICE**

San Juan County has submitted a request for an exemption from landfill design requirements to have ground water monitoring and a bottom liner in the waste disposal cell for the San Juan County Landfill located approximately 11 miles south of the City of Blanding, Utah. The basis for the request for an exemption from the *Utah Solid Waste Permitting and Management Rules* is site specific conditions including the geological setting, depth to ground water, and climate.

The exemption request has been reviewed by the Division of Solid and Hazardous Waste and has been determined to be complete. Before taking action on the request, the Division is providing a public comment period to receive input on the request. The public comment period begins May 13, 1998 and will end June 12, 1998. A public hearing may be held if, within 15 days of publication of the notice, a request is made to the Executive Secretary in writing and meets the requirements of Utah Administrative Code R315-311-3.

Copies of the exemption request documents are available for public review during the comment period during normal business hours at the following locations:

Utah Department of Environmental Quality  
Division of Solid and Hazardous Waste  
288 North 1460 West, 4th Floor  
Salt Lake City, Utah

San Juan County Administrator's Office  
117 South Main  
Monticello, Utah

Written comments will be accepted until 5:00 PM June 12, 1998 and should be submitted to:

Dennis R. Downs, Executive Secretary  
Utah Solid and Hazardous Waste Control Board  
Department of Environmental Quality  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880

In compliance with the Americans with Disabilities Act, individuals with special needs (including auxiliary communicative aids and services) during any of these public hearings should contact Human Resource Management at 536-4414 at least three working days prior to the hearing.

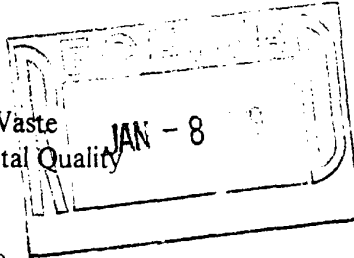
For further information contact Ralph Bohn or Jeff Emmons of the Division of Solid and Hazardous Waste at (801) 538-6170 or TDD 536-4414.

# VECTOR

ENGINEERING, INC.

April 2, 1998  
Project 975031.00

Jeff Emmons  
Division of Solid & Hazardous Waste  
Utah Department of Environmental Quality  
288 North 1469 West  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880



**RECEIVED**  
*express*  
APR 03 1998  
98.01450  
Division of Solid & Hazardous Waste  
Utah Department of Environmental Quality

*Via Overnight Delivery*

**Re: Response Request for Additional Information #1  
Request for Waiver - San Juan County Landfill**

Dear Jeff,

On behalf of San Juan County, Vector Engineering, Inc. (Vector) is pleased to submit this *Addendum to the Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill*, located in San Juan County, Utah. This document contains responses to the requests for additional information in your letter to Mr. Rick Bailey, Administrative Assistant for the San Juan County Commission, dated February 26, 1998. The request for additional information was a result of your technical review of the *Request for Suspension*.

This *Addendum to the Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill* will address the issues requiring resolution prior to the Utah Department of Environmental Quality (UDEQ) determining that the request is complete. This Addendum is presented in a comment and response format. Each of the comments is restated in the order and content they appear in your above-mentioned letter. Vector prepared the initial application on behalf of the facility owner, San Juan County, Utah, and is submitting this addendum in response to the UDEQ Request for Additional Information #1.

1. *In reference to section 6.2, "M" Aquifer Characteristics, of the Request for Suspension: If any of the permeability measurements referred to in Special Study 86 can be used and included to provide more site specific data, it should be included in the Request.*



## RESPONSE:

Based on a review of the available literature, the only reliable site specific permeability data available was obtained from the site investigation performed during development of this *Request for Suspension*. Permeability values mentioned in the literature are general values that can be associated with the geologic unit. Special Study 86 does not specify the location or number of samples obtained from a geologic unit to determine a general permeability for the formation. Therefore, it is not possible to be any more site specific with permeability information provided by the literature.

As discussed in section 7.0, Field Investigation, of the *Request for Suspension*, laboratory tests were performed on two samples collected during the site investigation. One relatively undisturbed sample was collected from a depth of approximately 10 feet in drill hole DH-2. This sample was used to estimate in-situ permeabilities of mudstone located immediately below the landfill. In-situ permeabilities of the immediate subsurface mudstone indicated that it had an approximate permeability of  $5 \times 10^{-8}$  centimeters per second (cm/sec). Index tests were performed on the undisturbed sample and the bulk sample obtained beneath the excavated disposal cell to determine if materials immediately beneath the landfill are similar to those used in the permeability test. According to the index tests, field classification of subsurface materials, and color, subsurface materials in the vicinity of the permitted disposal area appear to come from the same lithologic unit and have similar properties. Based on the description of the Brushy Basin Member and subsurface properties determined during the field and laboratory investigation, it can be concluded that materials in the immediate vicinity of the landfill are part of the Brushy Basin Member, and the very low permeability characteristic of these materials can be extrapolated across the site.

2. *In reference to section 6.5, Occurrence and Depth of Ground Water, of the Request for Suspension: a) the Request needs to clarify the discrepancy between the two drill log records; b) the Request needs to confirm the date of drilling and the location of the drill hole to 780 feet; and, c) the Request would be strengthened if it could be determined whether the water encountered at 770 feet below ground surface was under artesian conditions or water table conditions.*

## RESPONSE:

- a) Based on recent verbal communications with the driller, the deep boring was located adjacent to BB-2 (BE-2 on Figure 4) and identified as BB-2A. Comparison of the two bore logs supports information provided by the driller that the two bore holes were located adjacent to each other. Slight difference in the percentage makeup of subsurface materials at corresponding depths can be attributed to field classification error and are not unreasonable for borings drilled adjacent to one another. Therefore, the information stating that BE-1

was re-entered and drilled to 780 feet is incorrect. The deep boring was drilled adjacent to BB-2.

- b) As previously discussed, the location of the deep bore hole, BB-2A, was determined to be located adjacent to BB-2 (BE-2 on Figure 4). According to verbal communication with the driller, the drilling of BB-2A occurred between May 31 and June 2, 1993. The driller also indicated that BB-2A was drilled several months after the initial four exploratory borings were drilled. Bore logs for these four wells indicate they were drilled in September, 1993. According to the dates stated, the four shallow exploratory borings would have been drilled after the deep boring and not vice versa. Conversations with the driller and references made to the four exploratory borings in the permitting documents for the San Juan County Landfill (dated March, 1993) contradict the dates listed on the four borings logs, and support information recently provided by the driller indicating that the deep boring was drilled after the four shallow exploratory borings. The four exploratory borings had to be drilled prior to March, 1993 since they are referenced in the permitting documents. It is probable that the four borings were drilled in September, 1992.
- c) According to communications with the driller, the driller could not recall whether water in the deep exploratory boring, BB-2A, was under artesian conditions. The driller did note that in past encounters with the Morrison Aquifer the ground water was generally under artesian conditions. It was theorized by the driller that water in the deep boring, if allowed to stabilize, may have risen to a depth of approximately 680 feet, approximately 90 feet above the estimated location of the aquifer. The information provided by the driller corresponds with information presented in the San Juan County Landfill permitting documents concerning water depths in the nearest known water well located approximately two miles to southwest of the landfill. Records indicate that water in this well is located at an approximate depth of 650 feet. The casing elevation is unknown, but ground elevations in Section 17, where the well is located, are either equal to the elevation of the landfill or lower.

3. *In reference to section 7.0, Field Investigation, of the Request for Suspension:*
- a) the Request needs to explain what the criteria or rationale was used for selecting the number of holes and their location;*
  - b) Figure 4, Drill Hole Location Map, needs to be clarified to allow the reader to determine the approximate elevation of DH-3. If the elevation of the three holes are significantly different, the Request should correlate the drill hole logs based on their respective elevations;*
  - c) the Request needs to expand Section 7.0 to provide a greater explanation as to why these two samples are representative of the entire site; and,*
  - d) The raw data from the permeability testing, with review signatures, needs to be included in Appendix B.*



RESPONSE:

- a) The rationale used to select the number and location of exploratory borings was based on the literature reviewed and previous site specific information that was available. According to a literature review, it was determined that the landfill property was located on top of a laterally continuous formation referred to as the Brushy Basin Member (Hintz and Stokes, 1964). The literature indicated that this formation consisted of very low permeability, fine-grained materials, such as mudstone and sandstone, and Quaternary tectonism in this member has largely been absent (Gloyn, et. al., 1995; Hecker, 1993). A previous field investigation undertaken in February, 1993 for the permitting of the landfill indicated that site specific subsurface materials were laterally consistent across the landfill property, and similar to those specified in the literature review for the Brushy Basin Member. Appendix A of the *Request for Suspension* contains the previous and current field investigation boring logs. Based on the available information, it was postulated that near surface materials were consistent on the scale of the landfill property.

Due to the consistent nature of subsurface materials across the site, it was proposed that initially only three exploratory borings be drilled to verify site specific subsurface conditions. The three initial exploratory borings were located at three extreme points of the permitted disposal area to help verify the lateral continuity of subsurface materials in the vicinity of the permitted area. If varying conditions were encountered that warranted the drilling of additional exploratory borings, then additional bore holes would have been sited and drilled. Results of the three initial borings indicated that subsurface materials were similar at corresponding depths, and additional borings were not warranted. Bore logs for the previous and current subsurface investigation are contained in Appendix A of the *Request for Suspension*. The description of the Brushy Basin Member (Hintz and Stokes, 1964) correlates well with observations made in the field.

- b) Figure 4, Drill Hole Location Map, presents a topographic base map modified from the USGS Big Bench and No-Mans Island, Utah 7.5-Minute Quadrangles (1989) to illustrate the location of exploratory borings with respect to the landfill property. The location of all exploratory borings are approximate. Since exploratory borings were not surveyed and locations could only be approximated, top of boring elevations can only be approximated. The following exploratory boring elevations have been estimated based on field observations and approximate boring locations with respect to the landfill disposal cell and property boundary.

<u>Exploratory Boring No.</u>	<u>Approximate Elevation</u>
DH-1	5030 feet
DH-2	5040 feet
DH-3	5060 feet

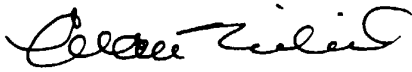
A detailed discussion of the boring logs has been included in Section 7.0 of the *Request for Suspension*. In general, the beginning elevation for the mudstone, or Brushy Basin Member correlates well between all three wells. The difference in elevation of the top of each boring is due to the presence of a thin aeolian deposits layer consisting of silty-sand. The upper five feet in DH-2 and upper 17.5 feet in DH-3 were comprised of this material. The material was previously removed from the surface at DH-1 during excavation of the construction and demolition waste disposal cell.

- c) The correlation of subsurface properties obtained from laboratory testing of site soils to the subsurface materials in the immediate vicinity of the landfill is supported by three sources of information. The first source of information was the literature review. As discussed in section 5.0, General Geologic Setting, the upper most geologic unit in the immediate vicinity of the landfill is the Brushy Basin Member, which consists of very low permeability, fine grained materials, such as mudstone and sandstone (Gloyn, et. al., 1995; Hecker, 1993). According to the literature, this formation is most likely laterally continuous on the scale of the landfill property. The second source of information was the field investigations performed at the landfill to verify that the general geological setting discussed in section 5.0 is applicable at the site. Bore logs from a previous field investigation are attached in Appendix A and indicate that near surface soils consist mainly of indurated fine grained materials such as mudstone and sandstone. Bore logs from the current field investigation strengthened the argument that similar subsurface materials across the permitted disposal area are laterally continuous. The bore logs indicate the presence of similar materials at corresponding depths between all three exploratory borings. Finally, two samples from two different locations were tested in the laboratory to verify that the materials were similar in nature. Results of these tests are discussed in section 7.0, Field Investigation. These test results indicate that both samples have approximately the same properties and classification. In addition, these samples were also observed to have similar visual and physical properties as the drill cuttings from the current site investigation at corresponding depths. There was also a high correlation of field observations and laboratory test results to the general characteristics of the Brushy Basin Member cited in the literature review. Therefore, it is postulated that the two samples tested are representative of immediate subsurface properties in the vicinity of the landfill property, or more importantly, the immediate vicinity of the permitted disposal area.
- d) The raw data from the laboratory permeability testing, with review signatures, is attached to this submittal.

On behalf of San Juan County, thank you for your consideration of this submittal. If you have any additional questions or comments regarding the response to comments, please contact me at your convenience.

Sincerely,

**Vector Engineering, Inc.**



Evan Nikirk, P.E.  
Project Manager

cc: Rick Bailey, Commissioner's Assistant, San Juan County, Utah

*attachments*

n:\975031\draft\response #1.doc

## PERMEABILITY TEST SUMMARY

**Client: VECTOR - CARSON CITY**  
**Project: SAN JUAN COUNTY**

**Project No.: 975031.00-689**

**Test Type: ASTM D-5084C**

**Date:** Oct. 18, 1997

<b>Sample Identification:</b>	<b>DH-2</b> 10.0-10.5'				
<b>INITIAL:</b>					
Moisture Content (%):	19.0				
Dry Density (pcf):	106				
Saturation (%):	86				
Porosity (%):	37.4				
Void Ratio:	0.598				
<b>FINAL:</b>					
Moisture Content (%):	29.7				
Dry Density (pcf):	94				
Saturation (%):	100				
Porosity (%):	44.5				
Void Ratio:	0.802				
<b>TEST RESULTS:</b>					
"B" Parameter:					
Hydraulic Conductivity (cm/sec):	5.3E-08				
Effective Consolidation Pressure (psi):	10				
Gradient Range:	6-7				
Notes:					

NOTES: De-aired tap water was used as permeant.  
The above Saturation, Porosity and Void Ratio are based upon an assumed Specific Gravity of 2.70.

Reviewed By: 

**QUALITY CONTROL CHECK - (Internal Use Only)**

Client Name:

VECTOR-CARSON CITY

Project:

SAN JUAN COUNTY; No. 975031.00

Sample I.D.:

DH-2

Soil Description:

Gray Claystone

MOISTURE DATA	Before Test		After Test			TEST DATA	
	Specimen	Trimming	Specimen	Washings	Total		
Tare + Wet Soil Wt. (gm):		45.82	526.71			Specific Gravity (assumed)	2.70
Tare + Dry Soil Wt. (gm):		43.11	423.53	50.30		Chamber Pressure (psi)	70.00
Moisture Loss Wt. (gm):		2.71	103.18			Back Pressure (psi)	60.00
Tare Weight (gm):		27.21	75.99	50.18		Eff. Consol Press. (psi)	10.00
Wet Soil Weight (gm):	413.86	18.61	450.72		450.88	Burette Area (cm <sup>2</sup> )	1.0000
Dry Soil Weight (gm):	347.66	15.90	347.54	0.12	347.66	C Factor (Final)	0.11334
Moisture Content (%):	19.04	17.04	29.69		29.69	*B* Check	0.00

SPECIMEN DATA		Initial	Change	Saturated	Change	Consolidated	Change	Final
Sample Length (in.)		2.742				2.855		2.855
Sample Diameter (in.)		2.414				2.513		2.513
Sample Length (cm)		6.96				7.25		7.25
Sample Diameter (cm)		6.13				6.38		6.38
Sample Area (cm <sup>2</sup> )		29.54				31.99		31.99
Dial Reading (cm)								
Burette Reading (cm)				15.20	2.30	17.50		
Solids Weight (cc)	Ws	347.66		347.66		347.66		347.66
Volume Total (cc)	Vt	205.71	28.57	234.28	2.30	231.98	0.01	231.99
Volume Solids (cc)	Vs	128.76		128.76		128.76		128.76
Volume Voids (cc)	Vv	76.95		105.52		103.22		103.23
Volume Water (cc)	Vw	66.20		105.52		103.22		103.22
Moisture Content (%)	M%	19.04		30.35		29.69	29.69	29.69
Wet Density (pcf)	Dw	125.60		120.76		121.34		121.33
Dry Density (pcf)	Dd	105.51		92.64		93.56		93.56
uration (%)	S	86.03		100.00		100.00		99.99
osity (%)	n	37.38		45.01		44.47		44.47
Void Ratio	e	0.598		0.819		0.802		0.802

#	Day	Hrs.	Min.	Time Change t (sec.)	In Burette Reading	In Change Out Change	Out Burette Reading	Burette Change (In-Out)	Air Head (psi)	Total Head h (cm)	Hydraulic Gradient	Hydraulic Conductivity k (cm/sec)
1.	0	7	40	0	45.7	0.4	0.9	44.8	0	44.8	6	
	0	13	1	19290	45.3	0.0	0.9	44.4	0	44.4	6	5.28e-8
2.	1	7	50	0	45.3	1.3	0.5	44.8	0	44.8	6	
	1	7	50	67740	44.0	0.0	0.5	43.5	0	43.5	6	4.93e-8
3.	0	7	50	0	44.0	0.5	0.5	43.5	0	43.5	6	
	0	16	40	31800	43.5	0.0	0.5	43.0	0	43.0	6	4.12e-8
4.	0	16	40	0	43.5	0.2	2.0	41.5	0	41.5	6	
	0	18	41	7280	43.3	0.0	2.0	41.3	0	41.3	6	7.54e-8
5.	1	18	41	0	43.3	0.7	2.0	41.3	0	41.3	6	
	1	7	33	46320	42.6	0.2	2.2	40.4	0	40.4	6	5.39e-8
6.	0	7	33	0	42.6	0.3	2.2	40.4	0	40.4	6	
	0	12	35	16120	42.3	0.0	2.2	40.1	0	40.1	6	4.66e-8
7.	8	7	0	0	50.1	0.2	0.1	50.0		50.0	7	
	10	27	8400		49.9	0.0	0.1	49.8		49.8	7	5.41e-8
8.												
9.												
10.												

Confining Pressure	Gradient (high)	7	AVERAGE PERMEABILITY:	5.3e-8
10 psi	Range (low)	6		

By signing the data and results represented on this page, Client agrees to limit the liability of Vector Engineering, Inc. from Client and all other parties for claims arising out of the use of this data to the cost for the respective test(s) represented herein, and Client agrees to indemnify and hold harmless Vector from and against all liability in excess of the aforementioned limit.

QC✓

File: 689A-txx.wq2

Printed: 03/31/98

Page 1 of 1

Reviewed By: [Signature]

Lab Log:

689'



Michael O. Leavitt  
Governor

Jeanne R. Nielson, Ph.D.  
Executive Director

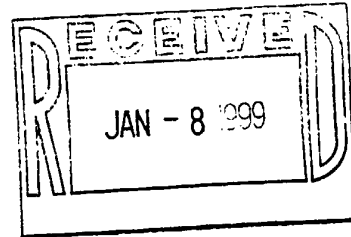
Dennis R. Downs  
Director

DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF SOLID AND HAZARDOUS WASTE

288 North 1460 West  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880  
(801) 538-6170  
(801) 538-6715 Fax  
(801) 536-4414 T.D.D.  
www.deq.state.ut.us Web

70 20595  
**FILE COPY**

February 26, 1998



Rick Bailey  
Administrative Assistant  
San Juan County Commission  
P.O. Box 9  
Monticello, Utah 84535

Re: Review of San Juan County Request of Suspension of Landfill Liner and Ground Water Monitoring Requirements - Request for Additional Information #1

Dear Mr. Bailey:

On December 16, 1997, the Division of Solid & Hazardous Waste (Division) received the *Request for a Suspension of Composite Liner and Ground Water Monitoring Requirements at the San Juan County Landfill, San Juan County, Utah; Prepared by Vector Engineering, Inc. (Request)*. Any resulting changes to the landfill plan of operation constitutes a major modification to the permit. The following review steps are required to process the Request.

1. The Division staff review the Request to determine it is complete.
2. If any additional information is needed, a *Request for Additional Information* will be issued by the Division.
3. The Division reviews the response to the *Request for Additional Information*.
4. Once the exchange of information is completed and the Division determines the Request is complete, a notice will be published announcing a thirty day public comment period on the proposed Request. If requested, a public hearing may be held during the public comment period.
5. All comments received during the public comment period will be reviewed to evaluate their technical merit. A *Response to Comments* will be issued by the Division.
6. Upon review and evaluation of all information received, the Executive Secretary of the Utah Solid & Hazardous Waste Control Board will determine whether the Request is approved,

Y900 347  
February 26, 1998  
Page 2

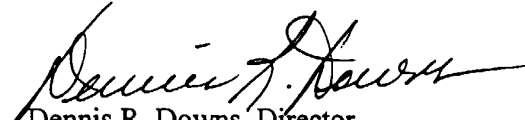
Y900

approved with conditions, or denied. Any changes in the landfill plan of operation will then be incorporated into the permit.

The Request has been reviewed and enclosed is the Request For Additional Information #1. Please provide three copies of your response to the request for additional information. The response will then be incorporated into the three copies of the submitted County Request

If you have any questions, please feel free to call either Jeff Emmons or Ralph Bohn with the Solid Waste Section at 801-538-6170.

Sincerely,

  
Dennis R. Downs, Director  
Division of Solid & Hazardous Waste

DRD/JE/sm

enclosure

c: Evan Nikirk, Vector Engineering, Inc.  
David Ariotti, DEQ District Engineer  
David Cunningham, B.S.N., R.N., Health Off/Dept Dir, Southeast Utah Dist Health Dept  
Rick Meyer, Southeastern Utah District Health Department

F:\SHW\SPBUEMMONS\WP\SANJUAN\RAI #1 Request for Variance  
File: San Juan County / San Juan County Landfill

# REQUEST FOR A SUSPENSION OF COMPOSITE LINER AND GROUND WATER MONITORING REQUIREMENTS

at the

SAN JUAN COUNTY LANDFILL  
SAN JUAN COUNTY, UTAH



## UTAH DIVISION OF SOLID & HAZARDOUS WASTE REQUEST FOR ADDITIONAL INFORMATION #1

February 27, 1998

The following underline items refer to the specific section of the San Juan County Request (Request). The bullets (●) are items that need to be address in the Request.

### 6.2 "M" Aquifer Characteristics

The Request states;

*The San Juan County Landfill is situated atop a section of the Brushy Basin Member of the Morrison Formation. The very low permeability of the Brushy Basin Member causes this member to act as a barrier to the movement of water except where fractured or faulted.*

The Utah Geological Survey, Special Study 86 titled *Mineral, Energy and Ground-Water Resources of San Juan County, Utah* is referenced in the Request. Page 19, of Special Study 86, contains a portion of Table 20 and discusses the characteristics of the Brushy Basin Member. It is stated;

*The Brushy Basin Member has a very low permeability (average less than 10 millidarices) and is a barrier to movement of water except where faulted or fractured.*

This average permeability statement implies that several permeability measurements have been taken. The Request may be strengthened if any of special study's permeability data can be applied to the landfill site.

- If any of the permeability measurements referred to in Special Study 86 can be use to provide more site specific data, it should be included in the Request.



### 6.5 Occurrence and Depth of Ground Water

Page 8 of the Request explains;

*The forth boring (BE-1) was originally terminated at 200 feet, but was re-entered and drilled to a depth of approximately 780 below ground surface. Free water was encountered in the fourth boring at a depth of 770 feet. The flow rate of ground water in the boring at 780 feet was determined to be on the order of 30 gallons per minute.*

The depth to water and well log data is a major factor in determining the landfill's potential impact to ground water. The accuracy of the BE-1 well bore hole is important. Appendix A provides the drill logs for the holes drilled by Bayles Exploration. The drill log for Hole BB1 (presumably the same as the holed referred to as BE-1 on page 8) is logged to 200 feet. The next page of the Appendix provides a drill log for a hole drilled to 780 feet. This well log is presumably BE-1 that was re-entered and drilled to 780 feet. Yet, the first two hundred feet of these two drill logs do not match. The second drill log to 780 feet does not include a location or a date of the drilling.

- The Request needs to clarify the discrepancy between the two drill log records.
- The Request needs to confirm the date of drilling and the location of the drill hole to 780 feet.
- The Request would be strengthened if it could be determined whether the water encountered at 770 feet below ground surface was under artesian conditions or water table conditions.

### 7.0 Field Investigation

This section explains that three vertical holes were drilled at the site (DH-1, DH-2, & DH-3) to depths of 100 feet. The drill holes were logged in the field.

- The Request needs to explain what the criteria or rational was for selecting the number of holes and their location.

Figure 4 is a map which provides elevation contours and locations of drill holes. The figure indicates drill holes DH-1 and DH-2 are at similar elevations. However, the label for DH-3 covers some of the contours and prevents the determination of the elevation for the hole.

- Figure 4 needs to be clarified to allow the reader to determine the approximate elevation of DH-3. If the elevation of the three holes are significantly different, the Request should correlate the drill hole logs base on their respective elevations.

Page 8 explains laboratory tests were performed on two samples collected during the site investigation. One sample was a relatively undisturbed sample in drill hole DH-2. A second

bulk sample was obtained from below the base of the existing disposal cell just south of the waste mass. Grain size distribution analyses, Atterberg limits testing, and a permeability test were conducted. Later in the section, a number of conclusions were drawn based on the test data.

- The Request needs to expand Section 7.0 to provide a greater explanation as to why these two samples are representative of the entire site.
- The raw data from the permeability testing, with review signatures, needs to be included in Appendix B.

F:\SHW\SPBJEMMONS\WP\SANJUAN\RAI #1 Request for Variance  
File: San Juan County/ San Juan County Landfill

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**APPENDIX E**  
**Patent and Right-of-Way Grant**

---

Application for Renewal  
San Juan County Landfill

# The United States of America

To all to whom these presents shall come, Greeting:

UTU-70117

Page 1 of 3

WHEREAS,

San Juan County, Utah

is entitled to a land patent pursuant to the Recreation and Public Purposes Act of June 14, 1926 (44 Stat. 741), as amended and supplemented (43 U.S.C. 869; et. seq.), for the following described land:

Salt Lake Meridian, Utah

T. 39 S., R. 22 E.,

Entry No. 15010310  
Recorded 7-10-95 at 8:24 A.M. by 745 Pg 338  
Fee Paid 340  
Recorder, San Juan County, Utah  
By L. L. Jones Deputy

sec. 3, W  $\frac{1}{2}$  SW  $\frac{1}{4}$  SW  $\frac{1}{4}$ , SE  $\frac{1}{4}$  SW  $\frac{1}{4}$  SW  $\frac{1}{4}$ ,  
S  $\frac{1}{2}$  NE  $\frac{1}{4}$  SW  $\frac{1}{4}$  SW  $\frac{1}{4}$ , S  $\frac{1}{2}$  SW  $\frac{1}{4}$  SE  $\frac{1}{4}$  SW  $\frac{1}{4}$ ;  
sec. 4, S  $\frac{1}{2}$  SE  $\frac{1}{4}$ ;  
sec. 9, NE  $\frac{1}{4}$ ;  
sec. 10, W  $\frac{1}{2}$  NW  $\frac{1}{4}$ , W  $\frac{1}{2}$  NE  $\frac{1}{4}$  NW  $\frac{1}{4}$ , NW  $\frac{1}{4}$  SE  $\frac{1}{4}$  NW  $\frac{1}{4}$ .

containing 390.00 acres

NOW KNOW YE, that the UNITED STATES OF AMERICA, in consideration of the premises, and in conformity with said Act of Congress, HAS GIVEN AND GRANTED, and by these presents DOES GIVE AND GRANT unto the said San Juan County, Utah, the land above described for use as a regional sanitary landfill: TO HAVE AND TO HOLD the same, together with all rights, privileges, immunities, and appurtenances, of whatsoever nature, thereunto belonging, unto the same San Juan County, Utah, forever; and

EXCEPTING AND RESERVING TO THE UNITED STATES:

1. A right-of-way thereon for ditches or canals constructed by the authority of the United States. Act of August 30, 1890 (43 U.S.C. 945).
2. All minerals, including oil and gas, in the land so patented with the right to prospect for, mine and remove the same. The Secretary of the Interior reserves the right to determine whether such mining and removal of mineral will interfere with the development, operation and maintenance of the sanitary landfill.
3. A right-of-way for an access road, Serial No. UTU-73243, pursuant to Title V of the Act of October 21, 1976 (43 U.S.C. 1767), and the right to enforce all or any of the terms and conditions of the right-of-way, including the right to renew or extend it upon its termination.

SUBJECT TO:

1. Those rights for a power transmission line located in sec. 9, W  $\frac{1}{2}$  NE  $\frac{1}{4}$ , granted to Pacificorp DBA UPL, its successors or assigns, by Right-of-Way No. UTU-

Patent Number 43-95-0023

338

RECORDED, SAN JUAN COUNTY, UTAH

1995 JUL 10 AM 8:24

338

24973, pursuant to the Act of March 4, 1911 (36 Stat. 1253; 43 U.S.C. 961) as amended by the Act of February 5, 1948 (62 Stat. 17).

2. Those rights for a power transmission line located in sec. 9, W½NE¼, granted to Pacificorp DBA UPL, its successors or assigns, by Right-of-Way No. UTU-57106, pursuant to the Act of March 4, 1911 (36 Stat. 1253; 43 U.S.C. 961) as amended by the Act of February 5, 1948 (62 Stat. 17).
3. Those rights for a power transmission line located in sec. 9, S½NE¼ and sec. 10, SW¼NW¼, NW¼SE¼NW¼, granted to Pacificorp DBA UPL, its successors or assigns, by Right-of-Way No. UTU-64139, pursuant to the Act of October 21, 1976 (90 Stat. 2776; 43 U.S.C. 1761).

San Juan County, Utah, its successors or assigns, assumes all liability for and shall defend, indemnify, and save harmless the United States and its officers, agents, representatives, and employees (hereinafter referred to in this clause as the United States), from all claims, loss, damage, actions, causes of action, expense, and liability (hereinafter referred to in this clause as claims) resulting from, brought for, or on account of, any personal injury, threat of personal injury, or property damage received or sustained by any person or persons (including the patentee's employees) or property growing out of, occurring, or attributable directly or indirectly, to the disposal of solid waste on, or the release of hazardous substances from the land described above, regardless of whether such claims shall be attributable to: (1) the concurrent, contributory, or partial fault, failure, or negligence of the United States, or (2) the sole fault, failure, or negligence of the United States.

Provided, that title shall revert to the United States upon a finding, after notice and opportunity for a hearing, that the patentee has not substantially developed the lands on or before the date five years after the date of conveyance. No portion of the land shall under any circumstance revert to the United States if any such portion has been used for solid waste disposal or for any other purpose which may result in the disposal, placement, or release of any hazardous substance.

If, at any time, the patentee transfers to another party ownership of any portion of the land not used for the purpose specified in this document, the patentee shall pay the Bureau of Land Management the fair market value, as determined by the authorized officer, of the transferred portion as of the date of transfer, including the value of any improvements thereon.

The above described land has been conveyed for utilization as a regional sanitary landfill. Upon closure, the site may contain small quantities of commercial and household hazardous waste as determined in the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901), and defined in 40 CFR 261.4 and 261.5. Although there is no indication these materials pose any significant risk to human health or the environment, future land uses should be limited to those which do not penetrate the final cover of this area unless excavation is conducted subject to applicable State and Federal requirements.

Patent Number 43-95-0023

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UTU-70117

page 3 of 3

In addition to the above the grant of the herein described land is subject to the following reservations, conditions, and limitations:

1. The patentee and its successors or assigns in interest shall comply with and shall not violate any of the terms or provisions of Title VI of the Civil Rights Act 1964 (78 Stat. 241), and requirements of the regulations, as modified or amended, of the Secretary of the Interior issued pursuant thereto (43 CFR 17) for the period that the lands conveyed herein are for the purpose for which the grant was made pursuant to the act cited above, or for another purpose involving the provision of similar services or benefits;
2. The United States shall have the right to seek judicial enforcement of the requirements of Title VI of the Civil Rights Act of 1964, and the terms and conditions of the regulations, as modified or amended, of the Secretary of the Interior issued pursuant to said Title VI, in the event of their violation by the patentee;
3. The patentee and its successors or assigns in interest will, upon request of the Secretary of the Interior or his delegate, post and maintain on the property conveyed by this document signs and posters bearing a legend concerning the applicability of Title VI of the Civil Rights Act of 1964 to the area or facility conveyed;
4. The reservations, conditions, and limitations contained in paragraphs (1) through (3) shall constitute a covenant running with the land, binding on the patentee and its successors or assigns in interest for the period for which the land described herein is used for the purpose for which this grant was made, or for another purpose involving the provision of similar services or benefits;
5. The assurances and covenant required by sections (1)-(4) above shall not apply to ultimate beneficiaries under the program for which this grant is made. "Ultimate beneficiaries" are identified in 43 CFR 17.1(h).



IN TESTIMONY WHEREOF, the undersigned authorized officer of the Bureau of Land Management, in accordance with the provisions of the Act of June 17, 1948 (62 Stat. 476), has, in the name of the United States, caused these letters to be made Patent, and the Seal of the Bureau to be hereunto affixed.

GIVEN under my hand, in Salt Lake City, Utah  
the Third day of July  
in the year of our Lord one thousand nine hundred and  
ninety-five and of the Independence of the  
United States the two hundred and nineteenth

By *James H. Cott*

Patent Number 43-95-0023

Chief, Branch of Lands and Minerals  
Operations

340

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  
RIGHT-OF-WAY GRANT

SERIAL NUMBER UTU-73244

---

1. A right-of-way is hereby granted pursuant to Title V of the Federal Land Policy and Management Act of October 21, 1976 (90 Stat. 2776; 43 U.S.C. 1761).
2. Nature of Interest:
  - a. By this instrument, the holder:

San Juan County Road Department  
P. O. Box 188  
Monticello, Utah 84535-0188

receives a right to construct, operate, maintain, and terminate an access road, on public lands described as follows:

Salt Lake Meridian, Utah

T. 39 S., R. 22 E.,  
Section 10, SENW.
  - b. The right-of-way area granted herein is 100 feet wide (26-28 foot travel surface), 590 feet long, and contains 1.35 acres, more or less.
  - c. This instrument shall terminate 30 years from its effective date unless, prior thereto, it is relinquished, abandoned, terminated, or modified pursuant to the terms and conditions of this instrument or of any applicable Federal law or regulation.
  - d. This instrument may be renewed. If renewed, the right-of-way shall be subject to the regulations existing at the time of renewal and any other terms and conditions that the authorized officer deems necessary to protect the public interest.

- e. Notwithstanding the expiration of this instrument or any renewal thereof, early relinquishment, abandonment, or termination, the provisions of this instrument, to the extent applicable, shall continue in effect and shall be binding on the holder, its successors, or assigns, until they have fully satisfied the obligations and/or liabilities accruing herein before or on account of the expiration, or prior termination, of the grant.

3. Rental:

For and in consideration of the rights granted, the holder agrees to pay the Bureau of Land Management fair market value rental as determined by the authorized officer unless specifically exempted from such payment by regulation. Provided, however, that the rental may be adjusted by the authorized officer, whenever necessary, to reflect changes in the fair market rental value as determined by the application of sound business management principles, and so far as practicable and feasible, in accordance with comparable commercial practices.

The holder is exempt from rental in accordance with 43 CFR 2803.1-2(b)(1).

4. Terms and Conditions:

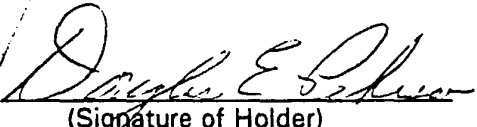
- a. This grant is issued subject to the holder's compliance with all applicable regulations contained in Title 43 Code of Federal Regulations part 2800.
- b. The right-of-way is issued subject to prior valid existing rights, including BLM right-of-way reservation UTU-73243 for an access road for administrative purposes and public use, right-of-way UTU-54719 for the Citizens Telecommunication Company of Utah buried telephone line, and right-of-way UTU-53840 for the Federal Highway Administration for highway purposes.
- c. Upon grant termination by the authorized officer, all improvements shall be removed from the public lands within 90 days, or otherwise disposed of as provided in paragraph (4)(d) or as directed by the authorized officer.
- d. Each grant issued for a term of 20 years or more shall, at a minimum, be reviewed by the authorized officer at the end of the 20th year and at regular intervals thereafter not to exceed 10 years. Provided, however, that a right-of-way granted herein may be reviewed at any time deemed necessary by the authorized officer.
- e. The stipulations, plans, maps, or designs set forth in Exhibits A and B, dated 04/04/95, attached hereto, are incorporated into and made a part of this grant instrument as fully and effectively as if they were set forth herein in their entirety.
- f. Failure of the holder to comply with applicable law or any provision of this right-of-way grant shall constitute grounds for suspension or termination thereof.
- g. The holder shall perform all operations in a good and workmanlike manner so as to ensure protection of the environment and the health and safety of the public.



- h. The holder shall conduct all activities associated with the construction, operation, and termination of the right-of-way within the authorized limits of the right-of-way.
- i. The holder of this right-of-way grant or the holder's successor in interest shall comply with Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d et seq.) and the regulations of the Secretary of Interior issued pursuant thereto.
- j. The holder shall contact the authorized officer at least seven (7) days prior to the anticipated start of construction and/or any surface disturbing activities. The authorized officer may require and schedule a preconstruction conference with the holder prior to the holder's commencing construction and/or surface disturbing activities on the right-of-way. The holder and/or his representative shall attend this conference. The holder's contractor, or agents involved with construction and/or any surface disturbing activities associated with the right-of-way, shall also attend this conference to review the stipulations of the grant including the plans(s) of development.
- k. The holder shall protect all survey monuments found within the right-of-way. Survey monuments include, but are not limited to, General Land Office and Bureau of Land Management Cadastral Survey Corners, reference corners, witness points, U.S. Coastal and Geodetic benchmarks and triangulation stations, military control monuments, and recognizable civil (both public and private) survey monuments. In the event of obliteration or disturbance of any of the above, the holder shall immediately report the incident, in writing, to the authorized officer and the respective installing authority if known. Where General Land Office or Bureau of Land Management right-of-way monuments or references are obliterated during operations, the holder shall secure the services of a registered land surveyor or a Bureau cadastral surveyor to restore the disturbed monuments and references using surveying procedures found in the Manual of Surveying Instructions for the Survey of the Public Lands in the United States, latest edition. The holder shall record such survey in the appropriate county and send a copy to the authorized officer. If the Bureau cadastral surveyors or other Federal surveyors are used to restore the disturbed survey monument, the holder shall be responsible for the survey cost.
- l. Fences, gates, and brace panels shall be reconstructed to appropriate Bureau standards and/or specifications as determined by the authorized officer.
- m. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the authorized officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer. An evaluation of the discovery will be made by the authorized officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the authorized officer after consulting with the holder.
- n. The holder shall be liable for damage or injury to the United States to the extent provided by 43 CFR 2803.1-5.

- o. Construction sites shall be maintained in a sanitary condition at all times; waste materials at those sites shall be disposed of promptly at an appropriate waste disposal site. "Waste" means all discarded matter including, but not limited to, human waste, trash, garbage, refuse, oil drums, petroleum products, ashes, and equipment.
- p. The holder shall furnish and apply water or other means satisfactory to the authorized officer for dust control.
- q. Prior to termination of the right-of-way, the holder shall contact the authorized officer to arrange a pretermination conference. This conference will be held to review the termination provisions of the grant.
- r. Upon relinquishment of the right-of-way, the holder will remove surfacing material (i.e. gravel, roadbase) and recontour disturbed areas or designated sections of the right-of-way by grading, to restore the site to approximately the original contour of the ground as determined by the authorized officer.
- s. The holder shall seed all disturbed areas, using an agreed upon method suitable for the location. Seeding shall be repeated if a satisfactory stand is not obtained as determined by the authorizing officer upon evaluation after the second growing season.

IN WITNESS WHEREOF, The undersigned agrees to the terms and conditions of this right-of-way grant.

  
(Signature of Holder)

\_\_\_\_\_  
(Signature of Authorized Officer)

  
(Title)

\_\_\_\_\_  
(Title)

  
(Date)

\_\_\_\_\_  
(Effective Date of Grant)

MAINTENANCE.

BEGINNING AT A POINT SOUTH 2380.13 FEET AND EAST 2294.93 FEET FROM THE NW CORNER OF SECTION 10, T39S R22E, SLB&M. SAID POINT LIES ON THE APPROX. R\W LINE OF HWY. 191 RUNNING THENCE N47°41'30"W 589.16'

RRATIVE:

THIS SURVEY WAS PERFORMED FOR SAN JUAN COUNTY TO SHOW BOUNDARIES OF THE SAN JUAN COUNTY LANDFILL. DESCRIPTIONS USED FOR ACCURING PROPERTY FROM THE B.L.M. USED ELOQUENT PARTS. THIS SURVEY USED CALCULATED FEET AND BOUNDS TO SHOW APPROXIMATE LOCATIONS OF BOUNDARIES. BASIS OF BEARING FOR ALL DESCRIPTIONS USED THE LINE BETWEEN THE E CORNER AND THE SOUTH 1\4 CORNER OF SECTION 4, T39S R22E, SLB&M BEING N89° 58'W

ATIONS ARE BASED ON U.S.G.S. BM. #D23  
ELFV. 4982.693

IT #	ELEVATION
1	5024
2	5039
3	5011
4	5028
5	5020
6	5022
7	5051
8	5052
9	5075
10	5046
11	4992
12	4988
13	4987
14	5018
15	5039

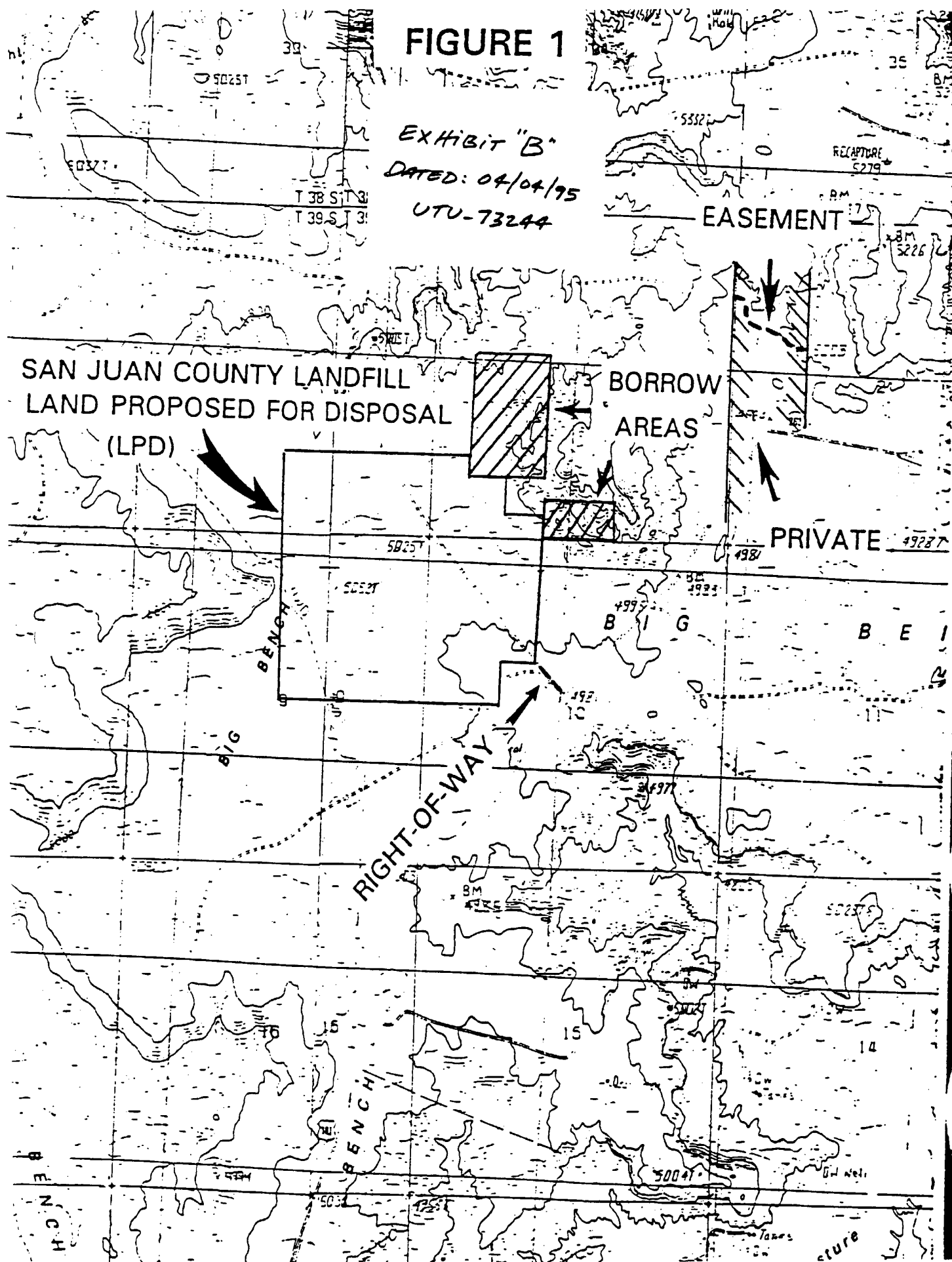
EXHIBIT "A"  
DATED: 04/04/95  
UTU-73244

SURVEYOR AS  
AND  
IFY THAT I  
PROPERTY  
ENTATION OF

SAN JUAN COUNTY SURVEY OFFICE		
PROJECT: SAN JUAN COUNTY LANDFILL		
DRAWN: CAB	DATE: 01-04-95	CLIENT:
APPROVED BY:	DATE:	

FIGURE 1

EXHIBIT "B"  
DATED: 04/04/95  
UTV-73244



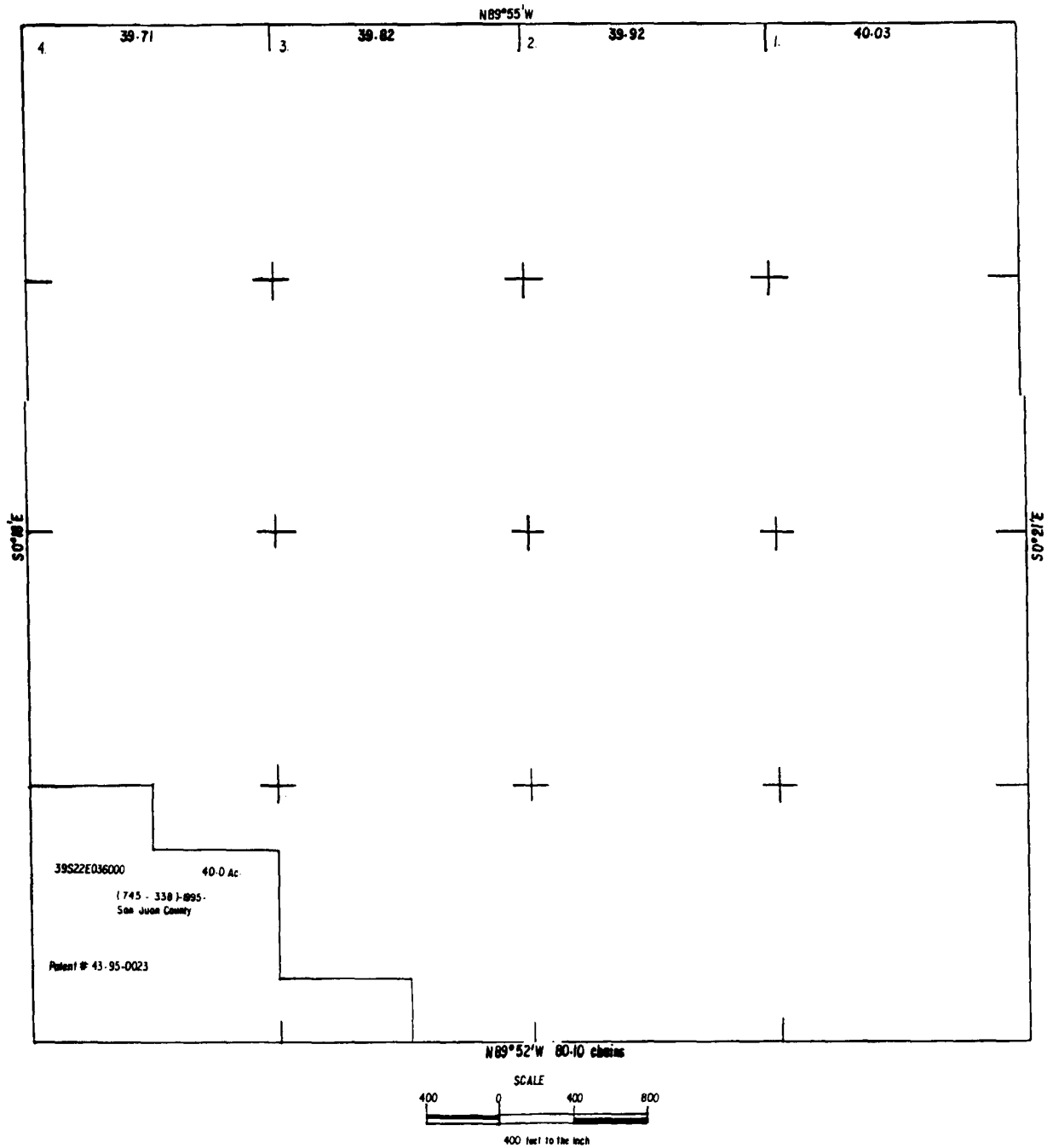
**APPENDIX F**  
**Required Location Documentation**

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Application for Renewal  
San Juan County Landfill

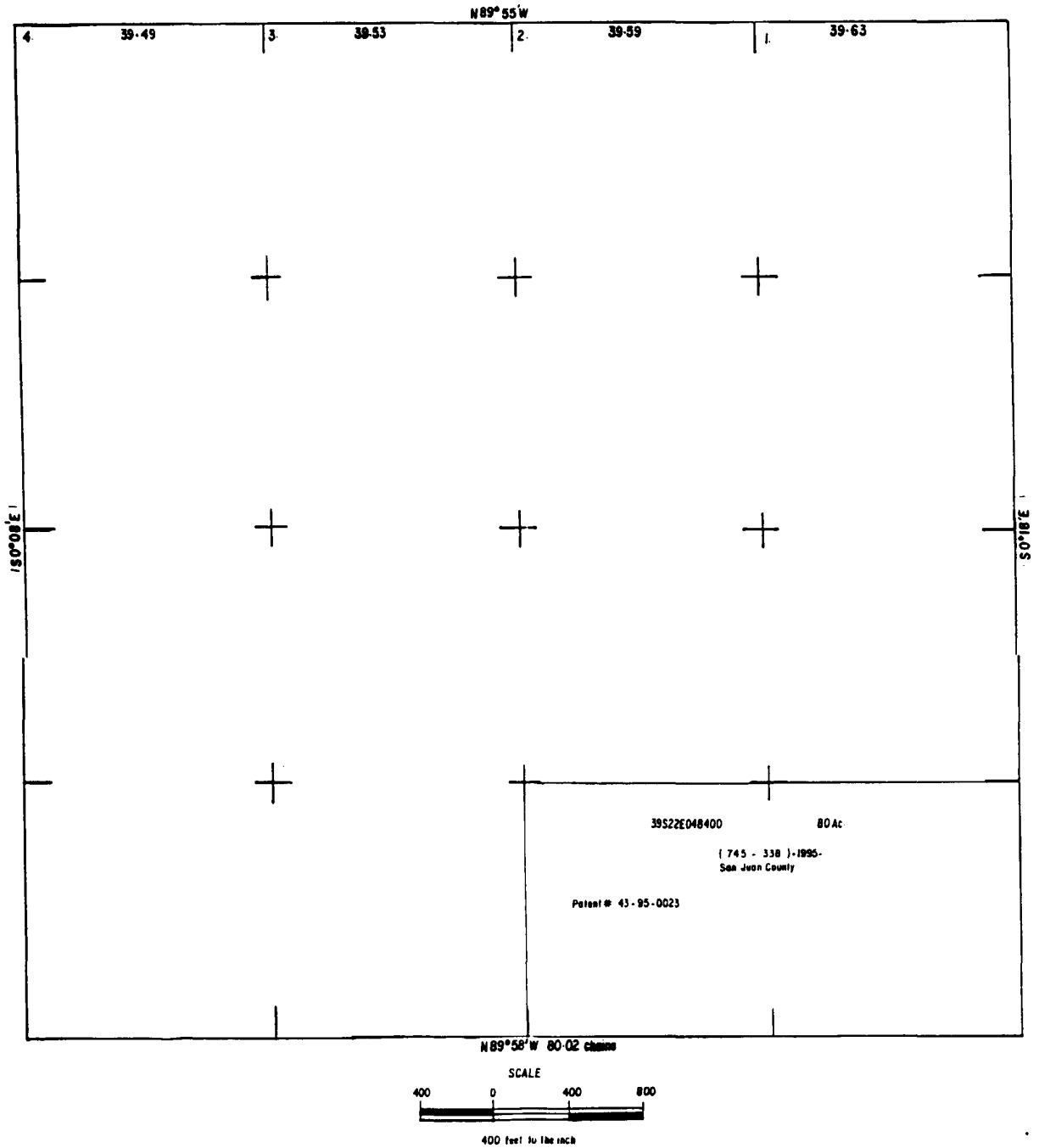
# SAN JUAN COUNTY, UTAH

SECTION 3 T 39 S R 22 E SALT LAKE MERIDIAN, UTAH



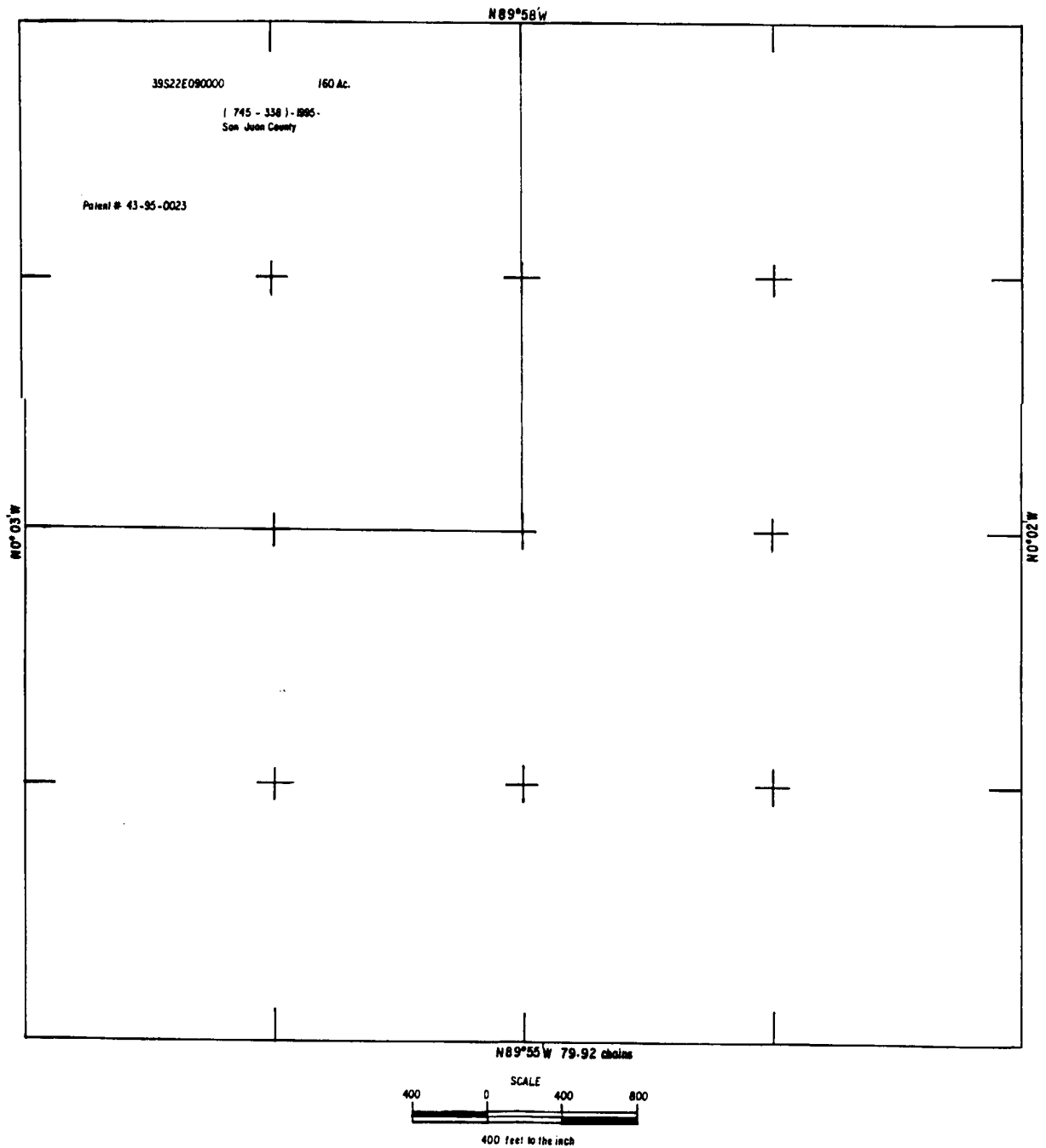
# SAN JUAN COUNTY, UTAH

SECTION 4 T 39 S R 22 E SALT LAKE MERIDIAN, UTAH



# SAN JUAN COUNTY, UTAH

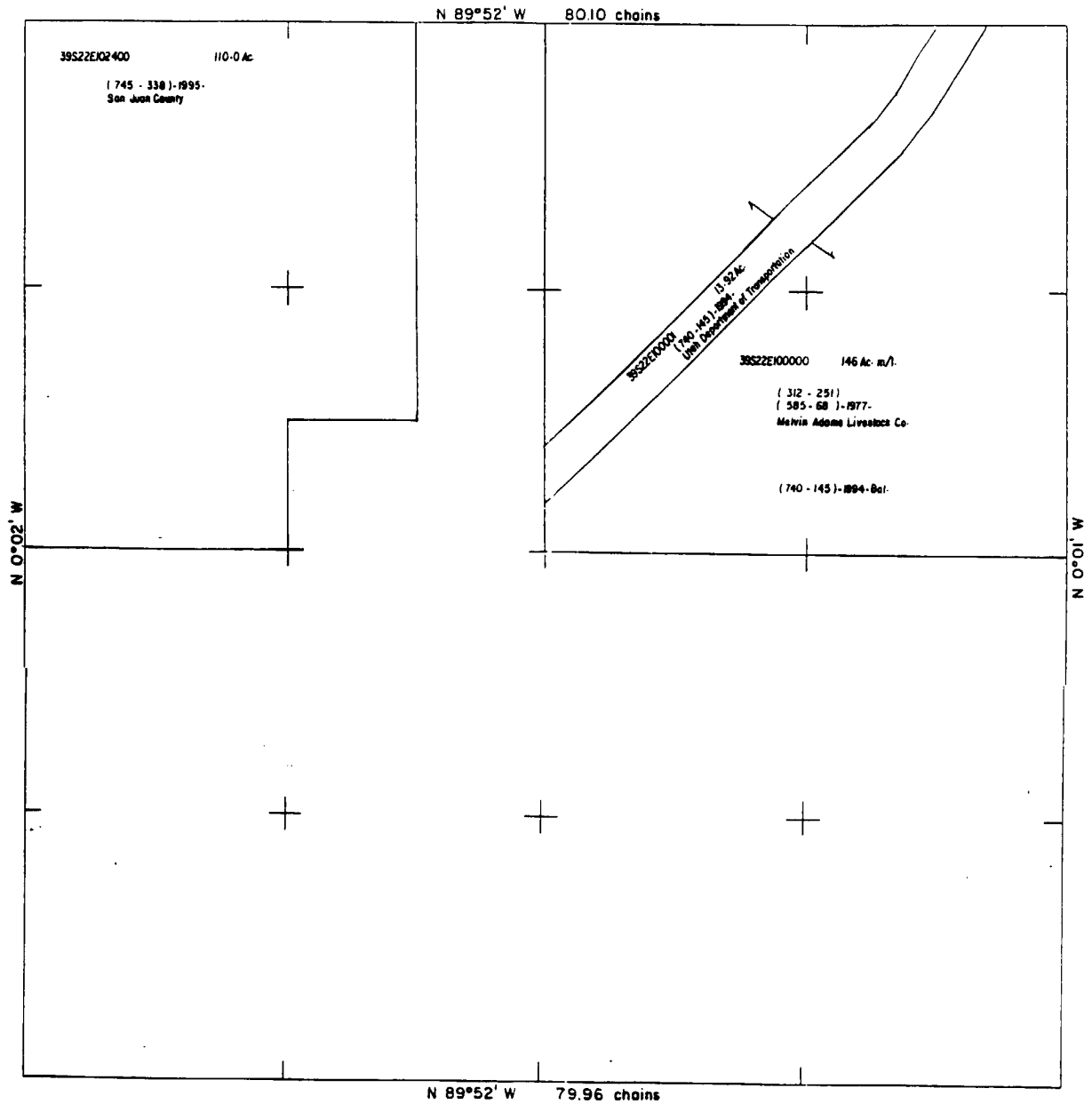
SECTION 9 T 39 S R 22 E SALT LAKE MERIDIAN, UTAH





# SAN JUAN COUNTY, UTAH

SECTION 10 T 39 S R 22 E SALT LAKE MERIDIAN, UTAH





September 30, 1998

United States  
Department of  
Agriculture

Natural  
Resources  
Conservation  
Service

P.O. Box 11350  
Salt Lake City, UT  
84147-0350

Phone:  
801 524-4572

FAX  
801 524-4403

Breese Burnley  
Steffen Robertson and Kirsten  
1755 East Plumb Lane, Suite 241  
Reno, Nevada 89502

Dear Mr. Burnley:

We have evaluated your Important Farmland request for SRK Project No. 106801 for the San Juan County Landfill in San Juan County, Utah. The project area does not involve any prime, unique or statewide important farmland.

If we can be of further assistance, please call on us.

Sincerely,

A handwritten signature in cursive script, appearing to read "William D. Broderick".

WILLIAM D. BRODERSON  
State Soil Scientist



State of Utah  
DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF WILDLIFE RESOURCES

Michael O. Leavitt  
Governor

Ted Stewart  
Executive Director

John Kimball  
Division Director

Southeastern Region  
475 West Price River Drive, Suite C  
Price, Utah 84501-2860  
801-636-0260  
801-637-7361 (Fax)

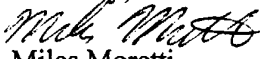
9 February, 1999

Mr. R. Breese Bumley  
Steffen Robertson and Kirsten  
1755 East Plumb lane #241  
Reno, NV 89502

RE: San Juan County Landfill

Dear Mr. Bumley,

In response to your letter requesting determination of the status of any "ecologically and scientifically significant natural areas" near the San Juan County Landfill, there are no Wildlife Management Areas or other areas we are concerned about in light of the renewal of this permit. Additionally, you requested information on Threatened or Endangered species in the vicinity. This area lies within prairie dog habitat, and where there are prairie dogs, there is a potential for occurrence of the endangered Black-footed Ferret. The last sighting of ferrets in Utah was a road kill within ten miles of the Landfill in question. I feel that initially a prairie dog survey should be completed. If prairie dog colonies exist on the permit area, a night spot-light ferret survey (based on the USFWS guidelines) be conducted. If there are questions on this issue, feel free to contact Derris Jones or Chris Colt at our office in Price (435)636-0264.

Sincerely,  
  
Miles Moretti  
Regional Supervisor



Washington, D.C. 20472

CERTIFIED MAIL  
RETURN RECEIPT REQUESTED

DEC 2 1985 DEC 1985  
IN REPLY, REF  
IA-RA-TO (205)  
**RECEIVED**

Community: San Juan County, Utah  
County: San Juan  
Community Number: 490109  
Current Effective Flood Hazard  
Boundary Map: January 31, 1978  
Rescission and Regular Program  
Conversion Effective: December 11, 1985

Honorable Calvin Black  
Chairman, San Juan County  
Board of Commissioners  
Monticello, Utah 84535

Dear Chairman Black:

Information recently made available to the Federal Insurance Administration indicates that, for all practical purposes, your community would not be inundated by the base flood, which is the flood having a one-percent chance of being equalled or exceeded in any given year. For this reason, we are rescinding the Flood Hazard Boundary Map (FHBM) and converting your community to the Regular Phase of the National Flood Insurance Program (NFIP) effective on the date cited above. Please destroy all copies of this map.

The effects of participating in the Regular Phase of the NFIP as a community with no Special Flood Hazard Areas (SFHAs) are:

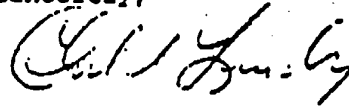
1. Any regulation of the NFIP with which the community may have been complying within areas designated as SFHAs (A zones) on an FHBM is no longer mandatory as a condition of your community's participation in the NFIP. However, it should be recognized that floods larger than the 100-year flood, which defines the SFHA, do occur. In view of your community's commitment, as expressed in the Resolution of Intent it adopted to qualify for initial eligibility in the NFIP, your community should exercise care in evaluating new development which could aggravate or create flood problems in your community or in adjacent communities.
2. The entire community will be placed in Zone C.
3. In addition, the maximum coverage available under the Regular Program is significantly greater than that available under the Emergency Program.

The Flood Disaster Protection Act of 1973 and various regulations of the NFIP (42 U.S.C. Section 4001-4128) utilize flood elevations based upon a 100-year frequency flood. Accordingly, FEMA has determined that no 100-year frequency flood elevation is known to exist in your community. Therefore, no map will be published.

In summary, by continuing its participation in the NFIP and the Regular Program, the community makes available to its citizens on a voluntary basis additional amounts of insurance coverage at generally lower rates than would be available under the Emergency Program. While no new flood plain management measures are required, your community is encouraged to implement regulatory measures to protect development against hazards as they are known to exist locally.

If you have any questions regarding this action, please contact the Chief, Natural and Technological Hazards Division of the Federal Emergency Management Agency in Denver, Colorado, at (303) 235-4830, or members of my staff in Washington, D.C., at (202) 646-2758.

Sincerely,

A handwritten signature in cursive script, appearing to read "Charles A. Lindsey".

Charles A. Lindsey, Chief  
Technological Operations Division  
Federal Insurance Administration



State of Utah  
DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF WATER RIGHTS

COPY

Michael D. Leavitt  
Governor  
Kathlene Clarke  
Executive Director  
Robert L. Morgan  
State Engineer

1584 West North Temple, Suite 220  
PO Box 146300  
Salt Lake City, Utah 84114-6300  
801-538-7240  
801-538-7467 (Fax)



FAX COVER SHEET

WATER RIGHTS INTERNET HOMEPAGE  
<http://nrwrt1.nr.state.ut.us/>

DATE: 9/15/98

TIME: \_\_\_\_\_

TO:

NAME: BREEZE BARNEY

AGENCY: \_\_\_\_\_

FAX NO. (702) 828-6820

FROM:

NAME: TERESA W.

AGENCY: UTAH DIVISION OF WATER RIGHTS

FAX: 801-538-7467

Number of pages being transmitted, including cover sheet 1

COMMENTS: Per your request, I hope this note is  
sufficient. I searched sections 3, 4, 9, 10, T39S,  
R82E. No water rights were found in  
these areas.



State Online Services

Agency List

Business.Utah.gov

Search Utah

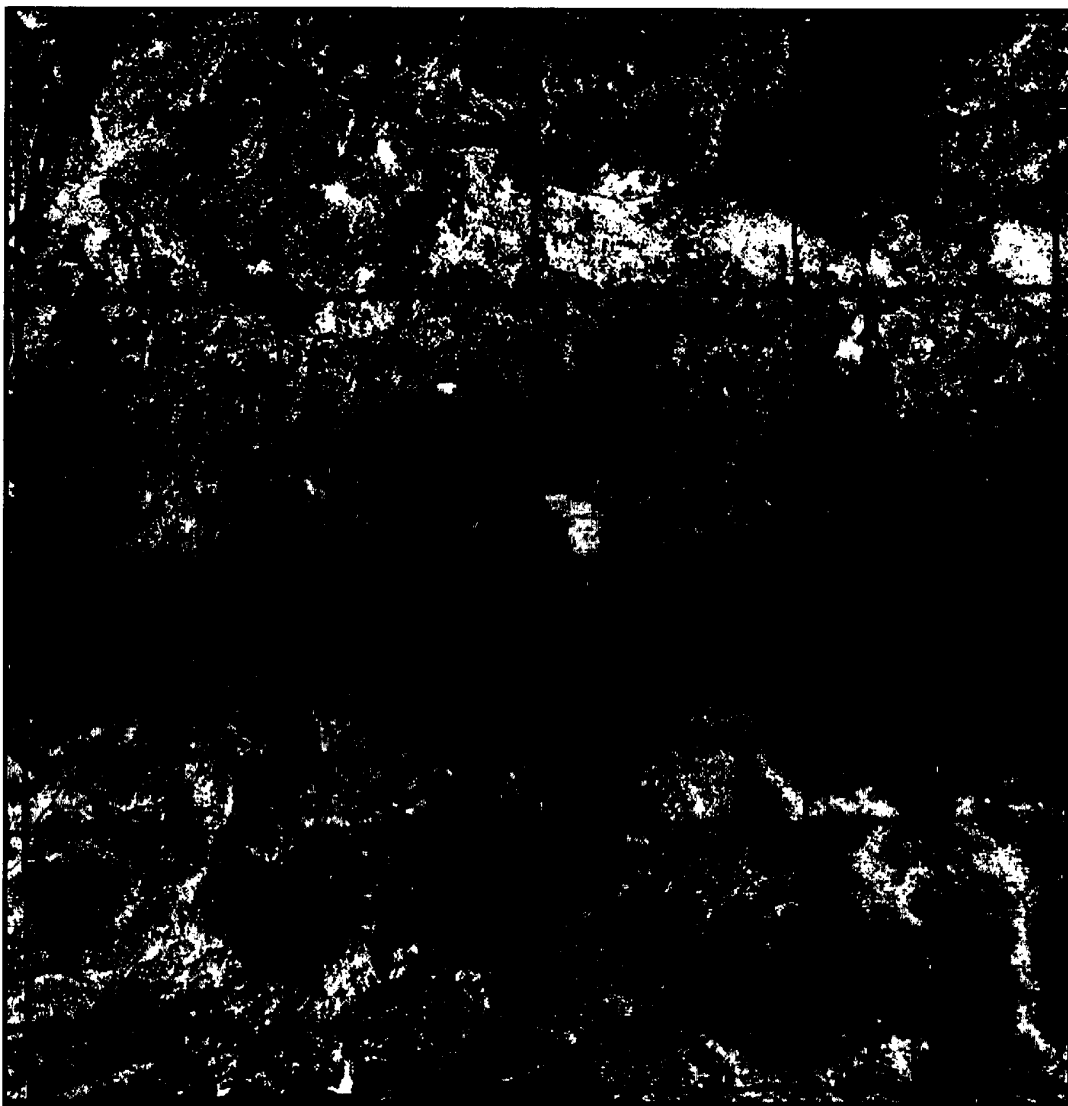
## UTAH DIVISION OF WATER RIGHTS

### WRPLAT Program Output Listing

Version: 2004.12.30.00

Rundate: 01/28/2005 02:46 PM

Search of Section 03, Township 39S, Range 22E, SL b&m Criteria:wrtypes=W,C,E podtypes=all  
status=U,A,P usetypes=all



0 1400 2800 4200 5600 ft

**Water Rights**

<b>WR Number</b>	<b>Diversion Type/Location</b>	<b>Well Log</b>	<b>Status</b>	<b>Priority</b>	<b>Uses</b>	<b>CFS</b>	<b>ACFT</b>	<b>Owner</b>
09-1480	Underground  S557 E592 NW 17 39S 22E SL		A	19860916	S	0.015	0.000	MOAB DISTRICT US LAND MANAGEMEN  P.O. BOX 970
09-2126	Underground  S582 E561 NW 10 39S 22E SL		A	20030715	M	0.000	4.730	SAN JUAN COUNTY  P.O. BOX 9
09-809	Underground  N1800 E1700 SW 17 39S 22E SL	well info	P	19770510	DS	0.015	0.000	TWO SWIPE CATTLE  A CORPORATION
09-994	Underground  S660 W660 NE 32 38S 22E SL		P	19771108	S	0.015	0.000	UTAH SCHOOL AND INSTITUTIONAL TR ADMIN.  675 EAST 500 SOUTH

[Natural Resources](#) | [Contact](#) | [Disclaimer](#) | [Privacy Policy](#) | [Accessibility Policy](#)



utah  
800

State Online Service

Utah.gov

Search Utah.gov

GO

## UTAH DIVISION OF WATER RIGHTS

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE

WRNUM: 09-2126 APPLICATION/CLAIM NO.: A75029 CERT. NO.:

OWNERSHIP\*\*\*\*\*

NAME: San Juan County  
ADDR: P.O. Box 9  
Monticello UT 84535  
LAND OWNED BY APPLICANT? Yes

DATES, ETC.\*\*\*\*\*

FILED: 07/15/2003 PRIORITY: 07/15/2003 PUB BEGAN: 08/06/2003 PUB ENDED: 08/13/2003 NEWSPAPER: San Juan Recor  
ProtestEnd: 09/02/2003 PROTESTED: [No ] HEARNG HLD: SE ACTION: [Approved] ActionDate: 10/15/2003 PROV  
EXTENSION: ELEC/PROOF: [ ] ELEC/PROOF: CERT/WUC: LAP, ETC: PROV  
RENOVATE: RECON REQ: TYPE: [ ]  
PD Book No. Map:

Type of Right: Application to Appropriate Source of Info: Application to Appropriate Status: Approved

LOCATION OF WATER RIGHT\*\*\* (Points of Diversion: Click on Location to access PLAT Program.)\*\*\*\*\*

FLOW: 4.73 acre-feet SOURCE: Underground Water Well (existing)  
COUNTY: San Juan COMMON DESCRIPTION: 9.5 miles N & E of Bluff

POINT OF DIVERSION -- UNDERGROUND: (Click Well ID# link for more well data.)

(1) S 582 ft E 561 ft from NW cor, Sec 10, T 39S, R 22E, SLBM

DIAMETER OF WELL: 05 ins. DEPTH: to 800 ft. YEAR DRILLED: WELL LOG? No WELL ID#:   
Comment:

PLACE OF USE OF WATER RIGHT\*\*\*\*\*

	NORTH-WEST¼ NW NE SW SE	NORTH-EAST¼ NW NE SW SE	SOUTH-WEST¼ NW NE SW SE	SOUTH-EAST¼ NW NE SW SE
Sec 10 T 39S R 22E SLBM	* X: : : *	* : : : *	* : : : *	* : : : *

-----

**USES OF WATER RIGHT**\*\*\*\*\*

-----

WATER RIGHT CLAIMS IN COMMON:           2126

-----

###MUNICIPAL: San Juan County

-----

**OTHER COMMENTS**\*\*\*\*\*

-----

County Landfill - 9.5 miles N & E. of Bluff.  
This well was constructed under provisional request 02-09-009-P-01.  
The purpose of the well is to provide water to county residents during drought  
conditions and/or emergency purposes, such as fire protection. The water can  
be used for any purpose the applicant deems appropriate and necessary.

\*\*\*\*\*

\*\*\*\*\*E N D   O F   D A T A\*\*\*\*\*

\*\*\*\*\*

[Natural Resources](#) | [Contact](#) | [Disclaimer](#) | [Privacy Policy](#) | [Accessibility Policy](#)

JUL 23 2002

WATER RIGHTS  
PRICE  
CEILING

RECEIVED

~~JUN 12 2002~~

~~WATER RIGHTS~~  
~~PRICE~~

Well Drillers License No: Randee Bayles #486 Proposed No. of Wells: One

County: San Juan

Use back of form or additional paper if more room is needed

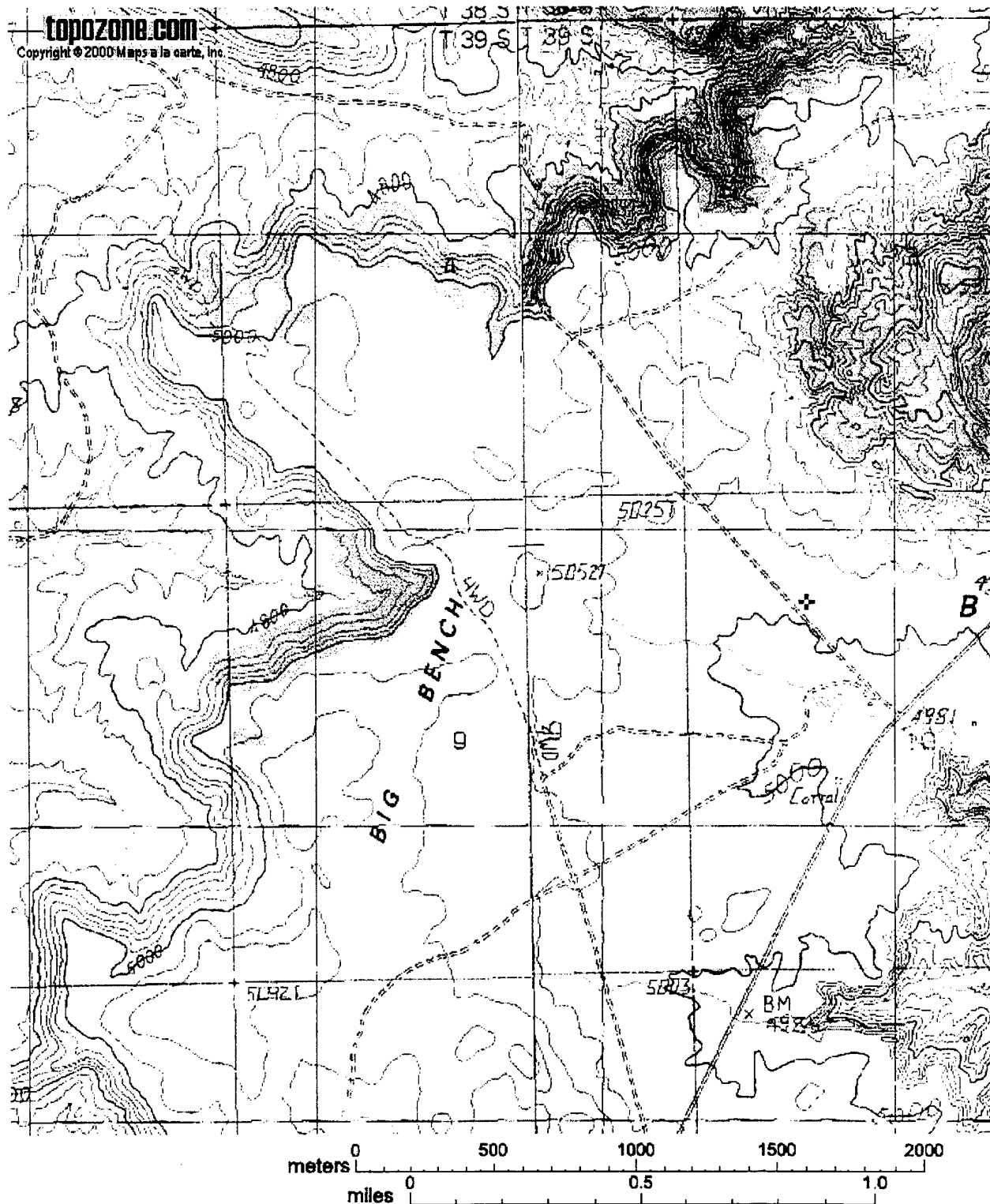
Specific Named Location: San Juan County Landfill

COUNTY ADMINISTRATOR

Water Right Number (if available): \_\_\_\_\_

### Request for Non-Production Well

Target is 37° 24' 53"N, 109° 29' 20"W - **BIG BENCH** quad [[Quad Info](#)]





State of Utah  
DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF WATER RIGHTS

Michael O. Leavitt  
Governor

Kathleen Clarke  
Executive Director

Robert L. Morgan  
State Engineer

Southeastern Area  
453 South Carbon Avenue  
PO Box 718  
Price, Utah 84501-0718  
435-637-1303  
435-637-7937 (Fax)

July 23, 2002

Rick M. Bailey  
San Juan County  
P.O. Box 9  
Monticello, Utah 84535

Dear Mr. Bailey:

Re: Provisional Well 02-09-009-P

Reference is made to your request to drill a provisional well at the following location:

- 1) S. 582 ft. & E. 561 ft. from NW Corner Section 3, T39S, R22E, SLB&M

The purpose of a provisional well(s) is to determine the quality and availability of an adequate water supply to be covered by an application to be filed with the Division of Water Rights.

letter grants you permission to proceed with the construction of the well with the understanding that this letter DOES NOT GRANT ANY PERMISSION OR APPROVAL TO PROCEED WITH THE DIVERSION OR USE OF THE WATER FOR ANY PURPOSE WHATSOEVER.

The well driller must have a current license with the State Engineer (if the well is to be deeper than 30 feet), and the well(s) must be constructed in accordance with the State of Utah Administrative Rules for Water Well Drillers.

Following completion and testing, the well casing either must be sealed with a tamper-resistant, water-tight cap, or permanently abandoned by the licensed driller (if deeper than 30 feet) before the drill rig is removed from the site.

Water may not be diverted from the provisional well and used for any beneficial purpose until proper authorization (approval) is granted by the State Engineer.

Please note that your permission to proceed with the drilling of the provisional well expires January 23, 2003.

Sincerely,

A handwritten signature in black ink, appearing to read 'Mark P. Page'.

k P. Page  
Regional Engineer

Enclosures  
MPP/mjk

# FILING FOR WATER IN THE STATE OF UTAH

Rec. by \_\_\_\_\_

Fee Rec. \_\_\_\_\_

Receipt # \_\_\_\_\_

## APPLICATION TO APPROPRIATE WATER

For the purpose of acquiring the right to use a portion of the unappropriated water of the State of Utah, application is hereby made to the State Engineer, based upon the following showing of fact, submitted in accordance with the requirements to Title 73, Chapter 3 of the Utah Code Annotated (1953, as amended).

\*WATER RIGHT NO. 09 - \_\_\_\_\_

\*APPLICATION No. \_\_\_\_\_

1. \*PRIORITY OF RIGHT: \_\_\_\_\_ \*FILING DATE: \_\_\_\_\_

2. OWNER INFORMATION

Name(s): San Juan County Interest: 100 %

Address: P.O. Box 9

City: Monticello State: Utah Zip Code: 84535

Is the land owned by the applicant? Yes X No \_\_\_\_\_ (If "No", please explain in EXPLANATORY section.)

3. QUANTITY OF WATER: \_\_\_\_\_ cfs and/or 4.73 ac-ft.

4. SOURCE: Underground Water Well (Existing) \*DRAINAGE: \_\_\_\_\_

which is tributary to \_\_\_\_\_

POINT(S) OF DIVERSION: \_\_\_\_\_ COUNTY: San Juan

S. 582 ft. & E. 561 ft. from NW Cor. Sec. 10, T39S, R22E, SLB&M

Description of Diverting Works: 5-inch casing, 800 feet deep

\*COMMON DESCRIPTION: County landfill - 9.5 miles N & E of Bluff

Big Bench Quad

5. POINT(S) OF REDIVERSION (if applicable)

The water will be rediverted from \_\_\_\_\_ at a point:

\_\_\_\_\_

\_\_\_\_\_

Description of Diverting Works: \_\_\_\_\_

6. POINT(S) OF RETURN (if applicable)

The amount of water consumed will be \_\_\_\_\_ cfs or 4.73 ac-ft.

The amount of water returned will be \_\_\_\_\_ cfs or \_\_\_\_\_ ac-ft.

The water will be returned to the natural stream/source at a point(s): \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

7. STORAGE (if applicable)

Reservoir Name: \_\_\_\_\_ Storage Period: from \_\_\_\_\_ to \_\_\_\_\_

Capacity: \_\_\_\_\_ ac-ft. Inundated Area: \_\_\_\_\_ acres.

Height of dam: \_\_\_\_\_ feet

Legal description of inundated area by 40 acre tract(s): \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\* These items are to be completed by the Division of Water Rights

Appropriate

8. List any other water right which will supplement the uses under this application \_\_\_\_\_

**NATURE AND PERIOD OF USE**

Irrigation:	From _____	to _____
Stockwatering:	From _____	to _____
Domestic:	From _____	to _____
Municipal:	From <u>January 1</u>	to <u>December 31</u>
Mining:	From _____	to _____
Power:	From _____	to _____
Other:	From _____	to _____

**10. PURPOSE AND EXTENT OF USE**

Irrigation: \_\_\_\_\_ acres. Sole supply of \_\_\_\_\_ acres.  
Stockwatering (number and kind): \_\_\_\_\_  
Domestic: \_\_\_\_\_ Families and/or \_\_\_\_\_ Persons.  
Municipal (name): San Juan County  
Mining: \_\_\_\_\_ Mining District in the \_\_\_\_\_ Mine.  
Ores mined: \_\_\_\_\_  
Power: Plant name: \_\_\_\_\_ Type: \_\_\_\_\_ Capacity: \_\_\_\_\_  
Other (describe): \_\_\_\_\_

**11. PLACE OF USE (Attach map)**

Legal description of place of use: NW $\frac{1}{4}$ NW $\frac{1}{4}$  Sec. 10, T39S, R22E, SLB&M  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**12. EXPLANATORY**

The following is set forth to define more clearly the full purpose of this application. (Use additional pages of the same size if necessary): This well was constructed under provisional request 02-09-009-P-01. The purpose of the well is to provide water to county residents during drought conditions and/or emergency purposes, such as fire protection. The water can be used for any purpose the applicant deems appropriate and necessary.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*\*\*\*\*

The applicant(s) hereby acknowledges that he/she/they are a citizen(s) of the United States of America or intends to become such a citizen(s). The quantity of water sought to be appropriated is limited to that which can be beneficially used for the purposes herein described. The undersigned hereby acknowledges that even through he/she/they may have been assisted in the preparation of the above-numbered application through the courtesy of the employees of the Division of Water Rights, all responsibility for the accuracy of the information contained herein, at the time of filing, rests with the applicant(s).

\_\_\_\_\_  
Signature of Applicant

\_\_\_\_\_  
Signature of Applicant

\*If applicant is a corporation or other organization, signature must be the name of such corporation or organization by its authorized agent, or in the name of the partnership by one of the partners.

SAN JUAN COUNTY

BY: Rick M Bailey  
RICK M. BAILEY  
COUNTY ADMINISTRATOR

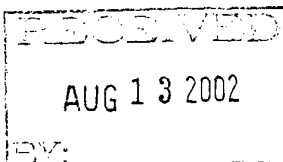
\_\_\_\_\_  
Authorized Agent (please print)

\_\_\_\_\_  
Authorized Agent (signature)

Faxed to  
Dayne 8/13/2002  
RicL

# WELL DRILLER'S REPORT

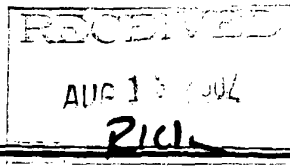
State of Utah  
Division of Water Rights  
For additional space, use "Additional Well Data Form" and attach BY:



Well Identification PROVISIONAL WELL: 02-09-009-P-01

Owner Note any changes  
San Juan County  
P.O. Box 9  
Monticello, UT 84535

Contact Person/Engineer:



Well Location Note any changes

SOUTH 582 feet EAST 561 feet from the NW Corner of  
SECTION 3, TOWNSHIP 39S, RANGE 22E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #)

Drillers Activity Start Date: 7-30-02 Completion Date: 8-7-02

Check all that apply: ☒ New ☐ Repair ☐ Deepen ☐ Clean ☐ Replace ☐ Public Nature of Use:

If a replacement well, provide the location of the new well. \_\_\_\_\_ feet north/south and \_\_\_\_\_ feet east/west of the existing well.

DEPTH (feet) FROM TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0 580	8 3/4	Rotary	Air mist
580 700	6 1/4	Rotary	Air mist
700	4 3/4	Rotary	Air mist

Well Log	DEPTH (feet) FROM TO	W A T E R	P E R M E A B L E	UNCONSOLIDATED							ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (e.g., relative %, grain size, sorting, angularity, bedding, grain composition, density, plasticity, shape, cementation, consistency, water bearing, odor, fracturing, mineralogy, texture, degree of weathering, hardness, water quality, etc.)
				C L A Y	S I L T	S S A N D	G R A V E L	C O B B L E	B L U E	O T H E R			
	0 5	X						X				White	
	5 10			XX								White	
	10 30			XX								Green	
	30 50	X									Sandstone	Yellow	
	50 60	X									"	Brown	
	60 70			XX								Grey	
	70 75	X									Sandstone	White	
	75 145	X									"	Grey	
	145 180	X									"	Brown	
	180 290	X									"	White	

Static Water Level

Date: 8-7-02 Water Level: 397 feet Flowing? ☐ Yes ☒ No

Method of Water Level Measurement: Salinast If Flowing, Capped Pressure: \_\_\_\_\_ PSI

Point to Which Water Level Measurement was Referenced: Surface Ground Elevation (If known): \_\_\_\_\_

Height of Water Level reference point above ground surface: \_\_\_\_\_ feet Temperature: \_\_\_\_\_ °C ☐ °F ☐



# ADDITIONAL WELL DATA FORM

Water Right # 02-09-009-P-01

OWNER NAME San Juan County

Page 2 of 2

Well Log		WATER	PERMEABLE high low	UNCONSOLIDATED					CONSOLIDATED		ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (e.g. relative %, grain size, sorting, angularity, bedding, grain composition, density, plasticity, shape, cementation, consistancy, water bearing, odor, fracturing, minerology, texture, degree of weathering, hardness, water quality, etc.)
DEPTH (feet) FROM	TO			CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER			
290	310		X									Red	
310	355		X									Brown	
355	385		X									Red	
385	395		X								sandstone	white	
395	410		X								sandstone	Brown	
410	430		X						X		shale	Red	
430	450		X								sandstone	white	
450	460		X								II	Brown	
460	465										II	white	
465	480		X						X		shale	Red	
480	510		X								sandstone	Brown	
510	575		X						X		shale	Red	
575	720		X								sandstone	Brown	Hit water at 580'
120	800		X								sandstone	Red	

## Construction Information

DEPTH (feet)		CASING CASING TYPE AND MATERIAL GRADE	WALL THICK (in)	NOMINAL DIAM (in)	DEPTH (feet)		<input type="checkbox"/> SCREEN	<input type="checkbox"/> PERFORATIONS	<input checked="" type="checkbox"/> OPEN BOTTOM
M	TO				FROM	TO	SCREEN SLOT SIZE (OR PERF SIZE) (in)	SCREEN DIAM (OR PERF LENGTH) (in)	SCREEN TYPE (OR NUMBER PERF (per round/interval))
+1 1/2	580	New Steel	250	5					

Well Head Configuration: WTC-5 Access Port Provided? ☒ Yes ☐ No  
 Casing Joint Type: T+c Perforator Used: N/A  
 Was a Surface Seal installed? ☒ Yes ☐ No Depth of Surface Seal: 10 feet Drive Shoe? ☐ Yes ☒ No  
 Surface Seal Material Placement Method: cuttings Provide Seal Material description below:

DEPTH (feet)		SURFACE SEAL / INTERVAL SEAL / FILTER PACK / PACKER INFORMATION		
FROM	TO	SEAL MATERIAL, FILTER PACK and PACKER TYPE and DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal., # bag mix, gal./sack etc.)
0	580	Neat cement pump down inside of casing and up the Annulus.	120 bgs	11,520 lbs

## Well Development and Well Yield Test Information

Date	Method	Yield	Units Check One		DRAWDOWN (ft)	TIME PUMPED (hrs & min)
			GPM	CFS		
	Air Test	36	<input checked="" type="checkbox"/>			

## Pump (Permanent)

Pump Description: \_\_\_\_\_ Horsepower: \_\_\_\_\_ Pump Intake Depth: \_\_\_\_\_ feet  
 Approximate maximum pumping rate: \_\_\_\_\_ Well disinfected upon completion? ☒ Yes ☐ No

Comments: Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment procedures. Use additional well data form for more space.

## Well Driller Statement

This well was drilled and constructed under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name: Byles Exploration Inc.  
 (Person, Firm, or Corporation - Print or Type)

License No. 486

Signature: R. L. J. Byles  
 (Licensed Well Driller)

Date: 8-8-02

SAMPLER: COMPLETE THE FOLLOWING - USE BALL POINT PEN				FOR LABORATORY USE ONLY		DATE RECEIVED	DATE REPORTED
1 SYSTEM NO. 11111	SAMPLE COLLECTED FROM: (CHECK ONE)		<input type="checkbox"/> 1. PUBLIC WATER SYSTEM	<input type="checkbox"/> 3. SWI	00L	8/27/92	
			<input checked="" type="checkbox"/> 2. PRIVATE WELL	<input type="checkbox"/> 4. STRE.		ANALYST TV	APPROVED BY J. Davis
WATER SYSTEM NAME: <u>SAN JUAN COUNTY LANDFILL</u>				COUNTY: <u>SAN JUAN</u>		RESULTS OF ANALYSIS	
EXACT DESCRIPTION OF SAMPLING POINT: <u>Well by State House</u>							
SAMPLE COLLECTED BY: <u>RICK HERRERA</u>							
DATE COLLECTED: <u>Aug 27, 1992</u>		TIME: (24 hr. CLOCK) <u>9:38 AM</u>					
IS SAMPLE CHLORINATED? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO				RESIDUAL		PPM	
ANALYSIS METHOD:							
<input type="checkbox"/> A. MEMBRANE FILTER				<input type="checkbox"/> C. MULTIPLE TUBE FERMENTATION			
<input checked="" type="checkbox"/> B. PRESENCE - ABSENCE				<input type="checkbox"/> D. MINI MAL MEDIA (MMO-MUG)			
<input type="checkbox"/> E. PLATE COUNT							
THIS SAMPLE IS A:							
<input type="checkbox"/> 1. ROUTINE SAMPLE.							
<input type="checkbox"/> 2. REPEAT SAMPLE LAB # _____ DATE: _____							
<input checked="" type="checkbox"/> 3. INVESTIGATIVE (NOT INCLUDED ON OFFICIAL RECORD)							
<input checked="" type="checkbox"/> 4. REPLACEMENT FOR INDETERMINATE SAMPLE							
SEND	NAME <u>S. E. U. D. H. D.</u>						
REPORT	ADDRESS <u>P.O. BOX 127</u>						
TO:	CITY/STATE <u>Price, Utah</u>						
	ZIP CODE _____						
				TELEPHONE NO. <u>845 35</u>			
Remarks: <u>none clearly</u>				Run Time <u>11:00</u>			
				Read Time <u>11:00</u>			
				F. <input type="checkbox"/> EXCESSIVE TIME ELAPSED (MUST ARRIVE AT LAB 30 HOURS AFTER COLLECTION)		H. <input type="checkbox"/> SAMPLE LEAKED. I. <input type="checkbox"/> LAB ERROR.	
				G. <input type="checkbox"/> CONSIDERED TOO OLD WHEN NO DATE GIVEN.		J. <input type="checkbox"/> OTHER.	

**APPENDIX G**  
**Record Keeping Forms**

---

Application for Renewal  
San Juan County Landfill

Mail to:  
Dennis R. Downs, Director  
Division of Solid and Hazardous Waste  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880

Date Entered: \_\_\_\_\_

## 2005 SOLID WASTE LANDFILL ANNUAL REPORT

### Administrative Information

Calendar or fiscal year of report: \_\_\_\_\_

If fiscal year, please provide period covered: From \_\_\_\_\_ To \_\_\_\_\_

Facility Name: \_\_\_\_\_

Facility Mailing Address: \_\_\_\_\_

(Number & Street, Box and/or Route)

City: \_\_\_\_\_, State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

County: \_\_\_\_\_

Contact's Name: \_\_\_\_\_ Phone No.: (\_\_\_\_\_) \_\_\_\_\_

Title: \_\_\_\_\_

Contact's Mailing Address: \_\_\_\_\_

Contact's Email Address: \_\_\_\_\_

#### Owner

Name: \_\_\_\_\_ Phone No.: (\_\_\_\_\_) \_\_\_\_\_

Mailing Address: \_\_\_\_\_

(Number & Street, Box and/or Route)

City: \_\_\_\_\_, State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

#### Operator *(Complete this section only if the operator is not an employee of the Owner shown above)*

Name: \_\_\_\_\_ Phone No.: (\_\_\_\_\_) \_\_\_\_\_

Mailing Address: \_\_\_\_\_

(Number & Street, Box and/or Route)

City: \_\_\_\_\_, State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

### Facility Type and Status

☐

Class I

☐

Class IIIb

☐

Class V

☐

Class II

☐

Class IVa

☐

Class VI

☐

Class IIIa

☐

Class IVb

Does the facility have a construction and demolition (C/D) cell as part of the permit (not operated under a separate permit number)? Yes \_\_\_\_\_ No \_\_\_\_\_

If facility was permanently closed during the year enter date closed: \_\_\_\_\_

### Annual Disposal

Total facility tons: \_\_\_\_\_ or cubic yards: \_\_\_\_\_

*If separate tonnages are available*

Municipal tons: \_\_\_\_\_ or cubic yards: \_\_\_\_\_

C/D tons: \_\_\_\_\_ or cubic yards: \_\_\_\_\_

Industrial tons: \_\_\_\_\_ or cubic yards: \_\_\_\_\_

# DAILY ENTRY REPORT

2004

[illegible]

LOADS \_\_\_\_\_ TOTAL WEIGHT \_\_\_\_\_ TOTAL TONS \_\_\_\_\_ DATE \_\_\_\_\_

COMMENTS \_\_\_\_\_

NATURE \_\_\_\_\_

SAN JUAN COUNTY LANDFILL  
SOUTH HWY 191  
WEEKLY RECEIPTS

[illegible]

SAN JUAN COUNTY LANDFILL  
SOUTH HIGHWAY 191 UTAH MILE MARKER 35  
QUARTERLY/PERIODIC SITE INSPECTION LOG

	DATE	TIME	COMMENTS	OK	INITIAL
BUILDINGS					
DUMP AREA					
EQUIPMENT					
FENCE					
GATES					
LITTER					
ROADS					
SCALES					
SIGNS					

REPAIRS NEEDED: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

IN TION BY: \_\_\_\_\_



SAN JUAN COUNTY LANDFILL

SOUTH HWY 191 MILE MARKER 35 PO BOX 5 BLANDING UTAH 84511

INSPECTION LOG

THIS DOCUMENT IS THE OFFICIAL FORM REQUIRED FOR COMPLIANCE WITH R315-301-7(5) (A) FOR THE SAN JUAN COUNTY LANDFILL.

DATE \_\_\_\_\_ TIME \_\_\_\_\_ : \_\_\_\_\_ WEATHER \_\_\_\_\_

INSPECTION TEAM: \_\_\_\_\_

CONTENTS OF LOAD \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

LOAD ORIGIN: \_\_\_\_\_

VEHICLE OWNER: \_\_\_\_\_

DRIVER: \_\_\_\_\_

OTHER INFORMATION: \_\_\_\_\_

\_\_\_\_\_

NAME OF INSPECTOR: \_\_\_\_\_

SIGNATURE OF INSPECTOR: \_\_\_\_\_

THIS FORM SHALL BE KEPT ON SITE OR AT ANOTHER CONVENIENT, PERMANENT OFFICE FACILITY FOR A MINIMUM OF 3 YEARS.

**SAN JUAN COUNTY  
LANDFILL OPERATION  
LANDFILL GAS MONITORING SHEET**

**DATE OF MONITORING:**

**MONITORING INSTRUMENT:**

LOCATION WITHIN LANDFILL	TIME	TEMPERATURE	WIND SPEED	SAMPLE

**NOTES:**

**MONITORING PERFORMED BY:**

ORIGINAL: LANDFILL    COPY: MONITOR    COPY: LANDFILL FILE AT ADMINISTRATIVE OFFICES

# MONTHLY FUEL REPORT

[illegible]

REPORTED BY \_\_\_\_\_ DATE \_\_\_\_\_

## SAN JUAN COUNTY LANDFILL OPERATIONS TIME SHEET

MONTH \_\_\_\_\_ 2004

EMPLOYEE NAME	ADDRESS	REGULAR HOURS	
SOCIAL SECURITY NO.		OVERTIME HOURS	

[illegible]

MONTHLY TOTALS: VACATION \_\_\_\_\_ SICK LEAVE \_\_\_\_\_ PERSONAL PREF. \_\_\_\_\_ ALL PURPOSE \_\_\_\_\_

EMPLOYEE SIGNATURE \_\_\_\_\_

DEPARTMENT SUPERVISOR \_\_\_\_\_

DATE DELIVERED TO PAYROLL DEPARTMENT \_\_\_\_ / \_\_\_\_ / \_\_\_\_

[illegible]

(TIRES PLACED IN TIRE PILE AFTER JULY 1<sup>ST</sup> 2001)(TIRES PLACED IN TIRE PILE AFTER JULY 1<sup>ST</sup> 2001)[illegible]



Utah Department of Environmental Quality  
Division of Solid and Hazardous Waste  
1-800-458-0145

## UTAH DIYer USED OIL LOG

### Acceptable Oil

Motor Oil  
Hydraulic Oils  
Transmission Fluids

### Unacceptable Materials

Solvents  
Paint & Varnishes  
Household Chemicals  
Anti-Freeze

Paint & Lacquer Thinners  
Insecticides  
Gasoline  
Any combination/mix of  
unacceptable materials with  
acceptable oil

*By signing this log, I certify that the materials submitted consist entirely of "Acceptable Oil" which was removed from a motor vehicle without charge.*

Name

Address

Date

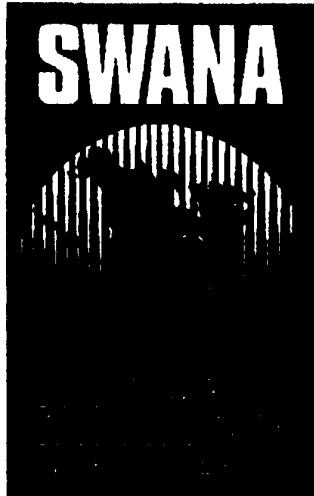
Volume

1.			
2.			
3.			
4.			
5.			
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15.			
16.			
17.			
18.			
1.			
20.			

**APPENDIX H**  
**Training Documentation, Procedures, and Selected Regulations**

Application for Renewal  
San Juan County Landfill





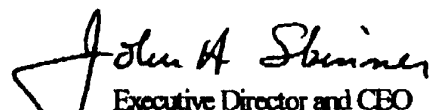
*This is to certify that*

**Harold Keylon**

*attended SWANA's Manager of Landfill Operations training course and passed the examination. After determination by review of experience, training and examination by the Solid Waste Association of North America is hereby designated a:*

**CERTIFIED TECHNICAL  
ASSOCIATE**

*This day, 7/16/99, for a term of three years.  
Certification No. 48332*

  
Executive Director and CEO

Advancing the practice of environmentally and economically sound municipal solid waste management in North America.

# SWANA REGISTRATION FORM

EDUCATE | INNOVATE | COMMUNICATE

☒ MR. ☐ MRS. ☐ MS.

NAME

Harold Keyton

# 48332

NICKNAME (FOR BADGE)

Landfill Worker

SWANA MEMBERSHIP #

San Juan County

TITLE

P.O. Box 5

ORGANIZATION

Landfill

ADDRESS

Blanding

Utah

STATE/PROVINCE

84511

ZIP/POSTAL CODE COUNTRY

CITY

435 678 3070

Same

FAX

PHONE

E-MAIL

NO Certificate  
Received

REGISTER TOLL-FREE BY PHONE:

CALL 1-800-GO-SWANA (467-9262)

OR FAX FORM TO:

Attn: Registration,  
301-589-7068 or  
301-585-0297

OR MAIL TO:

SWANA,  
Attn: Registration,  
PO Box 7219,  
Silver Spring, MD  
20907-7219

☐ Please check here if you are requesting vegetarian meals or have any dietary or ADA needs

	EARLY REGISTRATION	WITHIN 30 DAYS OF THE COURSE
<b>NEW ORLEANS, LA — JANUARY 14-17, 2002</b>		
<input type="checkbox"/> Mon-Wed, Manager of Landfill Operations (MLOLO)	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input checked="" type="checkbox"/> Testing Available for all Certifications on Thursday - Register Separately (Next Page)		
<b>HOUSTON, TX — FEBRUARY 27-MARCH 2, 2002</b>		
<input type="checkbox"/> Wed-Friday, Managing MSW Collection Systems	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Wed-Friday, Managing MSW Recycling Systems	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Wed-Friday, Managing MSW Transfer Systems	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Wed-Friday, Managing Composting Programs	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input checked="" type="checkbox"/> Testing Available for all Certifications on Saturday - Register Separately (Next Page)		
<input checked="" type="checkbox"/> Come earlier - register for the 12th Annual Waste Production, Recycling & Composting & 6th Annual Collection & Transfer Symposium (see <a href="http://www.swana.org">www.swana.org</a> for details)		
<b>MONTEREY, CA — MARCH 25, 2002</b>		
<input type="checkbox"/> Monday, Landfill Gas Basics	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input checked="" type="checkbox"/> Stay - register for the 25th Annual Landfill Gas Symposium (see <a href="http://www.swana.org">www.swana.org</a> for details)		
<b>LAS VEGAS, NV — MARCH 21-23, 2002</b>		
<input type="checkbox"/> Thurs-Sat., Construction & Demolition Debris	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input checked="" type="checkbox"/> Testing Available for all Certifications on Saturday - Register Separately (Next Page)		
<b>LAS VEGAS, NV — APRIL 15-18, 2002</b>		
<input type="checkbox"/> Mon-Wed, Manager of Landfill Operations (MLOLO)	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Mon-Wed, Managing MSW Collection Systems	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Mon-Wed, Managing MSW Transfer Systems	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Mon-Tues, Landfill Gas Operation & Maintenance	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input checked="" type="checkbox"/> Wed-Thurs, Landfill Operational Issues	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Thursday Outsourcing Decisions and Contracting Strategies: Risk & Rewards	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Monday, Collection Efficiency Workshop	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input checked="" type="checkbox"/> Testing Available for all Certifications on Thursday - Register Separately (Next Page)		
<b>PHILADELPHIA, PA — MAY 7-10, 2002</b>		
<input type="checkbox"/> Tues-Thurs, Manager of Landfill Operations	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input checked="" type="checkbox"/> Testing Available for all Certifications on Friday - Register Separately (Next Page)		
<b>LOUISVILLE, KY — JUNE 16-17, 2002</b>		
<input type="checkbox"/> Sat-Mon, Landfill Operational Issues	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input checked="" type="checkbox"/> Stay - register for the 7th Annual Landfill Management Symposium (see <a href="http://www.swana.org">www.swana.org</a> for details)		
<b>HALIFAX, NOVA SCOTIA, CANADA — JULY 10, 2002</b>		
<input type="checkbox"/> Wednesday, Paying for Your MSW Management System	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Wednesday, Outsourcing Decisions and Contracting Strategies: Risk & Rewards	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Wednesday, Employee Relations	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input type="checkbox"/> Wednesday, Training Sanitary Landfill Operating Personnel (TSLOP) <b>NEWLY UPDATED!</b>	<input type="checkbox"/> \$175	<input type="checkbox"/> \$175
<input checked="" type="checkbox"/> Stay - register for the 6th Annual Planning and Management Symposium (see <a href="http://www.swana.org">www.swana.org</a> for details)		



Cont. No.

Drivers License Number: 149610225

Course Completion Date: 2/10/2004

Security Control No.

9392003

Name: KEYLON, HAROLD  
Address: 390 W 100 S 54-4  
Address: BLANDING UT 84511  
City, State, Zip:

Training Center: UTAH SAFETY COUNCIL  
Instructor Name: GLENNA BLACK  
Instructor Number: 0099761

## ***Defensive Driving Course*** ***Four-Hour*** **CERTIFICATE OF COMPLETION**

This certifies that the person named  
above has successfully completed  
the National Safety Council four-hour Defensive Driving Course

THIS DOCUMENT IS VOID IF REPRODUCED



*Founded in 1913, the National Safety Council is a non-governmental, not-for-profit international public service organization devoted to protecting life and promoting health.*

*Our mission: to educate and influence society to adopt safety, health and environmental policies, practices and procedures that prevent and mitigate human suffering and economic losses arising from preventable causes.*

**Remember to use your safety belt.**  
**Keep children buckled, in the back seat.**



Control No.

KEYLON, HAROLD

has completed a National Safety Council's  
4-hour Defensive Driving Course

Drivers License Number: 149610225      Course Completion Date: 02/10/2004

*[Signature]*  
Alan C. McMillan, President

UTAH SAFETY COUNCIL  
TRAINING CENTER

Glenna Black      0099761  
Instructor Name      Instructor Number

Security Control No.

9392003

Keep this card for your records. Void if reproduced.

**REGISTRATION FORM**

SWANA LANDFILL OPERATOR TRAINING COURSE

May 25 &amp; 26, 2004 Cedar City, Utah

NAME William (Bill) Brandt JOB TITLE Landfill Operator  
ORGANIZATION San Juan County Landfill  
ADDRESS Box 9 Monticello UT 84535 PHONE # 435-567-3221

**REGISTRATION FEE**

(check one)

- ☐ I am a SWANA member (registration fee is \$100)
- ☐ I report directly to a SWANA member. (registration fee is \$100)  
The name of the SWANA member I report to is \_\_\_\_\_
- ☒ I am not a SWANA member and do not report directly to a SWANA member.  
(registration fee is \$150)

**METHOD OF PAYMENT**

(check one)

- ☐ Check Enclosed. (Make Checks Payable to: SWANA Beehive Chapter)
- ☐ Payment to be made at the course during the May 25th onsite registration.

**Payment Acknowledgment:** By signing this registration payment form, I understand that my I will be responsible for the payment of the registration fee.

SIGNATURE William M Brandt DATE 4/5/04

REGISTRATION MUST BE RECEIVED BY MAY 14th  
MAIL OR FAX THIS FORM TO:

Jeff Emmons  
SWANA Landfill Course Registration  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880

Fax: 801-538-6715  
Phone: 801-538-6748  
jemmons@utah.gov

## METHOD 9095A

### PAINT FILTER LIQUIDS TEST

#### 1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

#### 2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-min test period, the material is deemed to contain free liquids.

#### 3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

3.2 Temperature can affect the test results if the test is performed below the freezing point of any liquid in the sample. Tests must be performed above the freezing point and can, but are not required to, exceed room temperature of 25° C.

#### 4.0 APPARATUS AND MATERIALS

4.1 Conical paint filter: Mesh number 60 +/- 5% (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden.

4.2 Glass funnel: If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 in. of the filter mesh to protrude should be used to support the filter. The funnel should be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 Ring stand and ring, or tripod.

4.4 Graduated cylinder or beaker: 100-mL.

#### 5.0 REAGENTS

5.1 None.

#### 6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 All samples must be collected according to the directions in Chapter Nine of this manual.

6.2 A 100-mL or 100-g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids. If the sample is measured volumetrically, then it should lack major air spaces or voids.

## 7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter. If the sample is of such light bulk density that it overflow the filter, then the sides of the filter can be extended upward by taping filter paper to the inside of the filter and above the mesh. Settling the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.

7.3 In order to assure uniformity and standardization of the test, material such as sorbent pads or pillows which do not conform to the shape of the paint filter, should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the sorbent material with scissors, shears, knife, or other such device so as to preserve as much of the original integrity of the sorbent fabric as possible. Sorbents enclosed in a fabric should be mixed with the resultant fabric pieces. The particles to be tested should be reduced smaller than 1 cm (i.e., should be capable of passing through a 9.5 mm (0.375 inch) standard sieve). Grinding sorbent materials should be avoided as this may destroy the integrity of the sorbent and produce many "fine particles" which would normally not be present.

7.4 For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.

7.5 Allow sample to drain for 5 min into the graduated cylinder.

7.6 If any portion of the test material collects in the graduated cylinder in the 5-min period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

## 8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

## 9.0 METHOD PERFORMANCE

9.1 No data provided.

## 10.0 REFERENCES

10.1 None provided.

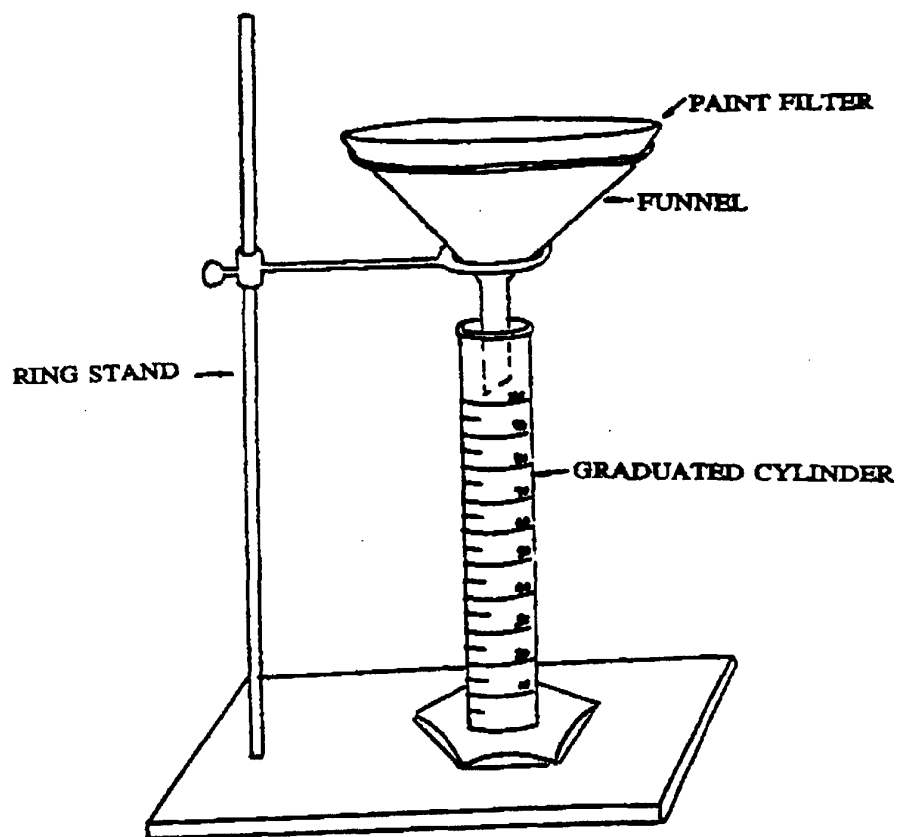
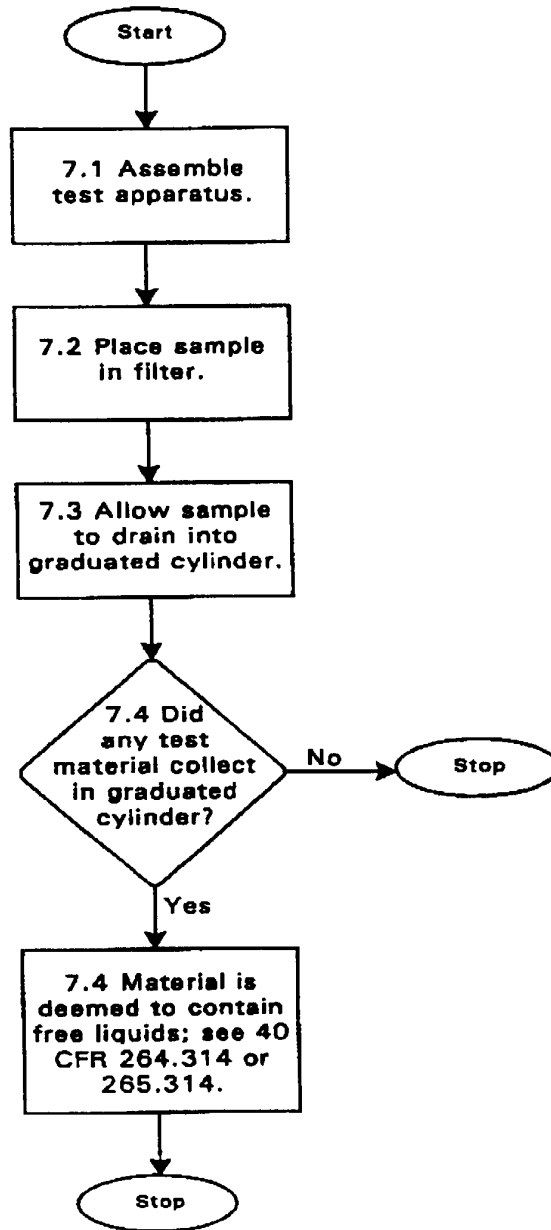


Figure 1. Paint filter test apparatus.

METHOD 9095A  
PAINT FILTER LIQUIDS TEST





**APPENDIX I**  
**Closure and Post-Closure Cost Estimates**

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Application for Renewal  
San Juan County Landfill

**2005 CLOSURE/POST- CLOSURE  
COST ESTIMATE  
LARGEST PREDICTED AREA  
San Juan County Landfill**

**CLOSURE/POSTCLOSURE COST SUMMARY SHEET - LARGEST PREDICTED AREA**

<u>CLOSURE CONSTRUCTION COSTS FOR LARGEST CLOSURE AREA</u>			<u>Comments</u>
1.0 SITE SECURITY AND FACILITIES		\$0	The County plans to progressively close portions of the landfill as waste filling proceeds south and east. Given the 51-year remaining life of the facility, the County anticipates performing closure activities on the order of every 10 years. It is anticipated that closure of Cell 1 (Dwg 6) will be the most costly.
1.1 Entrance Gate		\$0	
1.2 Perimeter Fencing		\$0	
1.3 Access Roads		\$0	
1.4 Contingency		\$0	
2.0 ENVIRONMENTAL CONTROL SYSTEMS		\$54,800	Final Cover Construction Area = 7.2 acres
2.1 Landfill Gas Monitoring System		\$0	
2.2 Ground Water Monitoring System		\$0	
2.3 Run-On Diversion Channel		\$0	
2.4 Storm Water Detention Basin		\$0	
2.5 Run-Off Collection System		\$47,400	
2.6 Contingency and Fees		\$7,400	
3.0 MSW DISPOSAL CELL CLOSURE CONSTRUCTION		\$206,300	The largest area requiring closure includes the in-place waste plus the next 10 years of waste plus the total area of the C&D cell.
3.1 Final Cover Design Parameters	n/a		
3.2 Final Cover Construction Costs		\$143,900	
3.3 Final Cover Monitoring Costs		\$35,100	
3.4 Contingency and Fees		\$27,300	
4.0 C&D DISPOSAL CELL CLOSURE CONSTRUCTION		\$49,400	Final Cover Construction Area = 1.6 acres
4.1 Final Cover Design Parameters	n/a		
4.2 Final Cover Construction Costs		\$33,700	
4.3 Final Cover Monitoring Costs		\$9,230	
4.4 Contingency and Fees		\$6,500	
TOTAL CLOSURE CONSTRUCTION COSTS		<u>\$310,500</u>	Area considered includes municipal and C&D cell
<u>POST-CLOSURE MAINTENANCE COSTS</u>			
1.0 SITE FACILITIES		\$1,625	
2.0 ENVIRONMENTAL CONTROL SYSTEMS		\$4,770	
3.0 FINAL COVER SYSTEM		\$2,980	
TOTAL ANNUAL POST-CLOSURE MAINT. COSTS		<u>\$9,375</u>	Cost includes site inspection and reporting
TOTAL POST-CLOSURE MAINT. COSTS (30 yrs)		<u>\$281,250</u>	

NOTE: Unit costs reported in this worksheet are derived from local and regional contractors and actual construction bids for similar earthworks and heavy construction projects.

**2005 CLOSURE/POST- CLOSURE  
COST ESTIMATE  
LARGEST PREDICTED AREA  
San Juan County Landfill**

**CLOSURE CONSTRUCTION COSTS**

<b>1.0 SITE SECURITY AND FACILITIES</b>				<u><b>Comments</b></u>
1.1 Entrance Gate			\$0	Already in-place.
1.2 Perimeter Fencing			\$0	Already in-place.
1.3 Access Roads			\$0	Installed during operational life of facility.
Subtotal			\$0	
1.4 Contingency @ 10%			\$0	
<b>TOTAL, SITE SECURITY AND FACILITIES</b>			<b>\$0</b>	
<b>2.0 ENVIRONMENTAL CONTROL SYSTEMS</b>				
2.1 Landfill Gas Monitoring System				Not applicable. The proposed landfill gas monitoring plan includes surface monitoring with a hand-held detector. Landfill gas monitoring wells are not proposed.
2.1.1 Gas Monitoring Plan			\$0	
2.1.2 Gas System and Well Design			\$0	
2.1.3 Gas Monitoring Well Installation			\$0	
Subtotal, LFG Monitoring System			\$0	
2.2 Ground Water Monitoring System				Not applicable. A request for suspension of GW monitoring requirements has been approved by UDEQ; no monitoring wells will be installed at the site.
2.2.1 Ground Water Monitoring Plan			\$0	
2.2.2 GW Monitoring Well Installation			\$0	
2.2.3 Well Casing Survey			\$0	
Subtotal, GW Monitoring System			\$0	
2.3 Storm Water Run-On Diversion Channel				Not applicable. The storm water run-on diversion channel will be constructed during the operational life of the facility. No channel construction activities will be required during final closure construction.
2.3.1 Channel Construction Costs				
Mob./Demob.	n/a		\$0	
Clearing and Grubbing	n/a		\$0	
Rough Excavation	n/a		\$0	
Finish Grading	n/a		\$0	
Water Truck	n/a		\$0	
48" CMP Culverts	n/a		\$0	
Rip-Rap Lining	n/a		\$0	
Subtotal			\$0	
2.3.2 Channel Construction Monitoring Costs				
Initial Survey Staking	n/a		\$0	
As-Built Survey	n/a		\$0	
Project Mgmt & Inspection	n/a		\$0	
Subtotal			\$0	
Subtotal, Storm Water Diversion Channel			\$0	Section 2.0 costs continued on next page...

**2005 CLOSURE/POST- CLOSURE  
COST ESTIMATE  
LARGEST PREDICTED AREA  
San Juan County Landfill**

**2.0 ENVIRONMENTAL CONTROL SYSTEMS, continued...****Comments****2.4 Storm Water Detention Basin****2.4.1 Basin Construction Costs**

Mob./ Demob.	n/a	\$0
Clearing & Grubbing	n/a	\$0
Rough Excavation	n/a	\$0
Finish Grading	n/a	\$0
Water Truck	n/a	\$0
Drop Inlet at Ditch	n/a	\$0
Culvert Under Road	n/a	\$0
Outlet Structure & Culvert	n/a	\$0
Rip-Rap Lining	n/a	\$0
Subtotal		\$0

Not applicable. Due to the division of on-site run-off into a number of sub-basins and the use of multiple discharge points (culverts), the final landfill configuration will not result in a significant change to local drainage characteristics, and a sedimentation basin is therefore not proposed.

**2.4.2 Basin Construction Monitoring Costs**

Initial Survey Staking	n/a	\$0
As-Built Survey	n/a	\$0
In-Situ Soils Testing	n/a	\$0
Project Mgmt & Inspection	n/a	\$0
Subtotal		\$0

Not applicable. See preceding comment.

**Subtotal, Storm Water Detention Basin****\$0****2.5 Storm Water Run-Off Collection System****2.5.1 Collection System Design Parameters**

Drainage Swale Length	300 ft.
Swale Erosion Matting	6,000 sq. ft.
Swale Rip-Rap Lining	170 cu. yds.
Headwall Berm Soil Vol.	89 cu. yds.
Berm Erosion Matting	1,500 sq. ft.
18" CMP Downdrain	200 ft.
18" CMP Culvert	80 ft.
Drop Inlets	2 ea.
Flared End Section	2 ea.
CMP T-Sections	1 ea.
CMP Elbow Section	1 ea.
V-Ditch on Top Deck Rd	875 ft.
V-Ditch on Perim. Road	1,000 ft.
Diversion Channel	0 ft.
Ditch Erosion Matting	1,000 sq. ft.
Ditch Rip-Rap Lining	30 cu. yds.

Swale length by 20 ft. wide  
 Nine-inch thick rip-rap lining  
 X-sect area = 16 sf, Length = 150 ft  
 150 ft. long by 10 ft. wide  
 From headwall berm to perimeter channel  
 2 culverts from perimeter channel under access road  
 1 drop inlet per culvert  
 1 flared section at downstream end of each culvert  
 At base of downdrain  
 At head of channel D21  
 Top deck access road west only  
 Assume east and south perimeter of cell only  
 Channel constructed during operations  
 At critical locations only - assume 100' @ 10' wide  
 Nine-inch total thickness.

**Section 2.0 costs continued on next page...**

**2005 CLOSURE/POST- CLOSURE  
COST ESTIMATE  
LARGEST PREDICTED AREA  
San Juan County Landfill**

**2.0 ENVIRONMENTAL CONTROL SYSTEMS, continued...****Comments****2.5 Storm Water Run-Off Collection System, continued...****2.5.2 Collection System Construction Costs**

Mob./ Demob.	\$0 l.s. =	\$0
Swale Fine Grading	\$5.53 / ft. =	\$1,660
Swale Erosion Matting	\$0.25 / sq. ft. =	\$1,500
Swale Rip-Rap Protection	\$66.35 / cu. yd. =	\$11,280
Headwall Berm Installation	\$5.00 / cu. yd. =	\$450
Berm Erosion Matting	\$0.25 / sq. ft. =	\$380
18" DOWNDRAIN INSTALL'n	\$33.17 / ft. =	\$6,630
18" Culvert Installation	\$33.17 / ft. =	\$2,650
Drop Inlet Installation	\$1,382.22 / ea. =	\$2,760
CMP T-Sections	\$387.02 / ea. =	\$390
Flared End Sec'n Install'n	\$276.44 / ea. =	\$550
CMP Elbow Sections	\$276.44 / ea. =	\$280
Ditch Fine Grading	\$5.53 / ft. =	\$10,370
Ditch Erosion Matting	\$0.25 / sq. ft. =	\$250
Ditch Rip-Rap Lining	\$66.35 / cu. yd. =	\$1,990

Subtotal \$41,100

**2.5.3 Collection System Construction Monitoring Costs**

Project Management	8 hrs	\$720
CQA Technician	40 hrs	\$1,600
Initial Survey Staking	\$2,000 l.s.	\$2,000
As-Built Survey	\$2,000 l.s.	\$2,000

Subtotal \$6,320

Subtotal, Storm Water Run-Off Collection System \$47,400

Subtotal, Environmental Control Systems \$47,400

**2.6 Contingency and Fees**

Contingency @ 10%	\$4,700
Bond Fees @ 1.5%	\$600
Contractor Fees @ 5%	\$2,100

**TOTAL, ENVIRONMENTAL CONTROL SYSTEMS \$54,800**

Included in final cover mob/demob

Purchase, delivery, and installation

Purchase, delivery, and installation

Soil loading, hauling, placement, grading, & comp'n

Purchase, delivery, and installation

Purchase, delivery, and installation

Purchase, delivery, and installation

Purchase, delivery, and installation

Purchase, delivery, and installation

Purchase, delivery, and installation

Purchase, delivery, and installation

Purchase, delivery, and installation

Purchase, delivery, and installation

Billing rate at \$90/hr

Assume 4 days at 10 hr/day, \$40/hr

Rounded to nearest \$100

Percent of construction costs only.

Percent of construction costs only.

**2005 CLOSURE/POST- CLOSURE  
COST ESTIMATE  
LARGEST PREDICTED AREA  
San Juan County Landfill**

**3.0 MUNICIPAL DISPOSAL CELL CLOSURE CONSTRUCTION****Comments****3.1 Final Cover Design Parameters**

Foundation Soil Thickness =	0.0 ft.
Infiltration Layer Thickness =	1.5 ft.
Erosion Layer Thickness =	0.5 ft.
Top Deck Final Cover Area =	33,100 sq. ft.
Adj. Sideslope Cover Area =	282,000 sq. ft.
Total Final Cover Area =	315,100 sq. ft.
	or 7.23 ac.
Total Final Cover Volume =	23,300 cu. yds.

12" Foundation layer placed during cell operation  
Native soil  
Native soil  
Top deck area, ridges and swales  
Adjusted area of sideslopes, incl. south slope  
Top deck plus adjusted sideslope areas

Constructed final cover volume

**3.2 Final Cover Construction Costs**

Mob./ Demob.	\$10,000 l.s. =	\$10,000
Foundation Finish Grading	\$0.05 / sq. ft. =	\$15,800
Foundation Compaction	\$0.11 / sq. ft. =	\$34,800
Water Truck	\$5,500 l.s. =	\$5,500
Infiltration Soil Acquisition	\$1.38 / cu. yd. =	\$32,200
Infiltration Soil Placement	\$0.39 / cu. yd. =	\$9,000
Erosion Soil Acquisition	\$1.11 / cu. yd. =	\$25,800
Erosion Soil Placement	\$0.28 / cu. yd. =	\$6,400
Surface Revegetation	\$608 / ac. =	\$4,400
<b>Subtotal</b>		<b>\$143,900</b>

On-site stockpiled soil, screening, loading & hauling  
Soil placement, grading, and compaction  
On-site stockpiled soils, loading and hauling  
Erosion soil placement, grading, and compaction

**3.3 Final Cover Construction Monitoring Costs**

Project Management	12 hrs	\$1,100
Project Manager Site Visits	\$2,300 l.s.	\$2,300
CQA Technician	230 hr.	\$11,000
Clerical / Lab Manager	\$2,200 l.s.	\$2,200
Mob./ Demob.	\$1,000 l.s.	\$1,000
Equipment	\$1,300 mo.	\$1,300
Direct Expenses	\$2,800 l.s.	\$2,800
Initial Survey Staking	\$2,400 l.s.	\$2,400
As-Built Surveying	\$5,000 l.s.	\$5,000
Final Certification Report	\$6,000 l.s.	\$6,000
<b>Subtotal</b>		<b>\$35,100</b>

Assume 4 weeks at 4 hr/wk and \$90/hr.  
Assume two site visits; including hourly rate & exp.  
Assume 1,000 cy/day; 23 days, \$48/hr, 10 hr/day

On-site testing equip. and trailer costs for 1 month  
Includes per diem, film, vehicle, shipping, & misc.  
Establish grid on top of foundation layer  
Top of infiltration and erosion layers, includes meets  
and bounds survey for title modification

**Subtotal, Disposal Cell Closure Construction** **\$179,000**

**3.4 Contingency and Fees**

Contingency @ 10%	\$17,900
Bond Fees @ 1.5%	\$2,200
Contractor Fees @ 5%	\$7,200

Percent of construction costs only.  
Percent of construction costs only.

**TOTAL, MUNICIPAL CELL CLOSURE CONST'N** **\$206,300**

**2005 CLOSURE/POST- CLOSURE  
COST ESTIMATE  
LARGEST PREDICTED AREA  
San Juan County Landfill**

**4.0 CONSTRUCTION/DEMOLITION CELL CLOSURE CONSTRUCTION****Comments****4.1 Final Cover Design Parameters**

Foundation Soil Thickness =	0.0 ft.
Cover Layer Thickness =	1.5 ft.
Topsoil Layer Thickness =	0.5 ft.
Top Deck Final Cover Area =	0 sq. ft.
Adj. Sideslope Cover Area =	69,300 sq. ft.
Total Final Cover Area =	69,300 sq. ft.
	or 1.59 ac.
Total Final Cover Volume =	5,100 cu. yds.

12" Foundation layer placed during cell operation  
Native soil w/compaction requirements  
Native topsoil, nominally compacted

Adjusted area sideslopes

Constructed final cover volume

**4.2 Final Cover Construction Costs**

Mob./ Demob.	I.s. =	\$0
Foundation Finish Grading	\$0.05 / sq. ft. =	\$3,500
Foundation Compaction	\$0.11 / sq. ft. =	\$7,700
Water Truck	\$5,500 I.s. =	\$5,500
Cover Soil Acquisition	\$1.38 / cu. yd. =	\$7,000
Cover Soil Placement	\$0.39 / cu. yd. =	\$2,000
Erosion Soil Acquisition	\$1.11 / cu. yd. =	\$5,600
Erosion Soil Placement	\$0.28 / cu. yd. =	\$1,400
Surface Revegetation	\$608 / ac. =	\$1,000
<b>Subtotal</b>		<b>\$33,700</b>

Included in final cover mob/demob

On-site stockpiled soil, screening, loading & hauling  
Soil placement, grading, and compaction  
On-site stockpiled soils, loading and hauling  
Erosion soil placement, grading, and compaction

**4.3 Final Cover Construction Monitoring Costs**

Project Management	4 hrs	\$400
Project Manager Site Visits	\$1,200 I.s.	\$1,200
CQA Technician	50 hr.	\$2,400
Clerical / Lab Manager	\$700 I.s.	\$700
Mob./ Demob.	\$0 I.s.	\$0
Equipment	\$1,300 mo.	\$330
Direct Expenses	\$1,700 I.s.	\$1,700
Initial Survey Staking	\$1,000 I.s.	\$1,000
As-Built Surveying	\$1,500 I.s.	\$1,500
Final Certification Report	\$0 see 3.3	\$0
<b>Subtotal</b>		<b>\$9,230</b>

Assume 1 week at 4 hr/wk and \$90/hr.

Assume 1 visit; including hourly rate & exp.

Assume 1,000 cy/day; 5 days, \$48/hr, 10 hr/day

Included in mob/demob for municipal cell constr.  
On-site testing equip. and trailer costs for 1 week  
Includes per diem, film, vehicle, shipping, & misc.  
Establish grid on top of foundation layer  
Top of infiltration and erosion layers, includes meets  
and bounds survey for title modification

**Subtotal, Disposal Cell Closure Construction** **\$42,930**

**4.4 Contingency and Fees**

Contingency @ 10%	\$4,300
Bond Fees @ 1.5%	\$500
Contractor Fees @ 5%	\$1,700

Percent of construction costs only.

Percent of construction costs only.

**TOTAL, C&D CELL CLOSURE CONSTRUCTION** **\$49,400**

**2005 CLOSURE/POST- CLOSURE  
COST ESTIMATE  
LARGEST PREDICTED AREA  
San Juan County Landfill**

**ANNUAL POST-CLOSURE MAINTENANCE COSTS**

			<u>Comments</u>
<b>1.0 SITE FACILITIES</b>			
1.1 Perimeter Fence Repairs	\$2.00 / ft. =	\$600	Assume 2% of fence perimeter needs annual repairs
1.2 Access Roads	\$875 / day	\$875	Assume one days' work once per year for grading
Subtotal		\$1,475	
1.3 Contingency @ 10%		\$150	
<b>TOTAL, SITE FACILITIES</b>		<b>\$1,625</b>	
<b>2.0 ENVIRONMENTAL CONTROL SYSTEMS</b>			
2.1 Landfill Gas Monitoring			Quarterly monitoring w/hand-held detector
Monitoring Event	\$360 / quarter	\$1,440	
Direct Expenses	\$100 / quarter	\$400	Expenses
Report Preparation	\$180 / quarter	\$720	
Project Management	\$90 / quarter	\$360	
Subtotal, Landfill Gas Monitoring System		\$2,920	
2.2 Ground Water Monitoring		\$0	Not applicable; no monitoring wells proposed at site
2.3 Leachate Collection System Monitoring		\$0	Not applicable; no LCRS proposed at site
2.4 Storm Water Collection/Diversion System Repairs			
Channel Inspection	\$90 / hour	\$540	3 hrs twice/year for travel, inspecting and reporting
Channel Repairs	\$875 / day	\$875	One days' work once per year for grading & repairs
Subtotal, Run-On Diversion Channel Repairs		\$1,415	
2.5 Storm Water Detention Basin Repairs			
Basin Inspection	\$90 / hour	\$0	No basin on site
Basin Repairs	\$875 / day	\$0	
Subtotal, Detention Basin Repairs		\$0	
Subtotal, Environmental Control Systems		\$4,300	Rounded to nearest \$100
2.6 Contingency and Fees			
Contingency @ 10%		\$430	
Contractor Fees @ 5%		\$40	Percent of construction costs only
<b>TOTAL, ENVIRONMENTAL CONTROL SYSTEMS</b>		<b>\$4,770</b>	Annual Post-Closure Maintenance Costs



**2005 CLOSURE/POST- CLOSURE  
COST ESTIMATE  
LARGEST PREDICTED AREA  
San Juan County Landfill**

**3.0 FINAL COVER SYSTEM**

Final Cover Inspection	\$90 / hour	\$540
Surface Revegetation	\$608 / acre	\$300
Final Cover Repairs	\$875 / day	\$1,750

Subtotal, Detention Basin Repairs \$2,600

Contingency @ 10%	\$260
Bond Fees @ 1.5%	\$30
Contractor Fees @ 5%	\$90

**TOTAL, FINAL COVER SYSTEM** **\$2,980**

Repair soils obtained from on-site stockpiles

3 hrs twice/year for travel, inspecting and reporting  
Assume repairs on 5% of surface area per year  
1 days' work twice per year for grading & repairs

Rounded to nearest \$100

Percent of construction costs only

Percent of construction costs only

Annual Post-Closure Maintenance Costs

**APPENDIX J**  
**Drainage Report**

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Application for Renewal  
San Juan County Landfill

**APPENDIX J**

**DRAINAGE SYSTEM DESIGN**

San Juan County Landfill  
San Juan County, Utah

Submitted as an integral component of the  
*Application for Renewal* of Permit 95-03R  
San Juan County Landfill

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## LIST OF FIGURES

- Figure J1 - Off-Site Drainage Sub-Areas 7 and 8

## LIST OF ATTACHMENTS

- Summary of Results
- Hydrologic Soil Group Description (USDA, 1993), Table 2-2d (USDA, 1986)
- TR-55 Results - Final Site Conditions
- FlowMaster Results - Final Site Conditions
- Rip-Rap Sizing Charts

## 1.0 INTRODUCTION

The following drainage report has been prepared as supporting documentation to the *Application for Renewal* of Permit 93-05R for the San Juan County Landfill and is included as Appendix J. The purpose of this drainage report is to present the methods used to determine the appropriate size and configuration of site drainage facilities necessary to collect and control the run-off resulting from a 25-year, 24-hour storm event following closure construction.

The San Juan County Landfill is located on the southwestern slope of a small sandstone knob, approximately 11 miles south of Blanding, Utah in San Juan County, Utah. The site is an existing permitted landfill for which San Juan County is seeking a permit renewal. The site receives approximately 30 tons per day, based on an annual average, and is therefore classified as a Class I solid waste disposal facility as defined by the Utah Administrative Code (UAC). Based on the favorable topography and availability of cover material in the vicinity of the existing disposal area, the landfill was designed in 1999 as a lateral expansion encompassing the existing waste footprint. Modifications from the 1999 design are depicted on Drawing 5 in the permit application, and with respect to changes affecting this Drainage Report, consist primarily of a 15-foot vertical expansion of the waste fill. The vertical expansion changes the relative areas of the top deck and sideslope drainage sub-areas (as depicted on Drawing 9 in Appendices A and M of the permit application), although the total area of the waste fill has not changed.

## 2.0 SYSTEM DESIGN

The proposed final drainage system design is illustrated on Drawings 5 and 9 in Appendices A and M of the *Application for Renewal*. The final configuration of the landfill has been designed to separate potential top deck storm flows from sideslope run-off, thereby minimizing the potential to erode the final cover at the critical slope intersection. Swales are designed to direct top deck run-off downslope to headwall diversion berms, then into downdrain culverts which discharge into the perimeter drainage network via energy-dissipating t-sections. The perimeter drainage channel network discharges flows via drop inlets and culverts beneath the perimeter access road and outside the proposed final waste footprint. By separating top-deck and sideslope drainage, and by designing sideslopes with a maximum slope of three to one (3:1, horizontal to vertical), the erosion potential due to surface run-off is minimized, refuse stability is maximized, and the potential to remove precipitation and prevent infiltration through the waste is enhanced.

The proposed perimeter drainage channels are designed as v-ditches, while swales are employed on the top deck. The v-ditches are 12 or 18 inches deep with sideslopes configured at a ratio of three-to-one, horizontal to vertical (3:1). A larger 24-inch-deep v-ditch is proposed along the up-slope perimeter of the waste footprint to ensure that potential run-on flows from up-slope drainage areas are diverted around the waste mass and into natural drainage channels to the north and east. Top deck swales are configured at 12 inches deep with 10:1 sideslopes. Channels and swales are graded as shown on Drawing 9; perimeter ditch grades vary with the access road grades. Due to the arid climate, which may make revegetation of fill slopes and site surfaces difficult, it is recommended that open channels with predicted flow velocities in excess of four feet per second and all bends and

critical intersections be constructed with an erosion fabric and rip-rap lining to minimize scouring from concentrated flows.

Downdrain culverts are positioned as shown on Drawing 9 to divert run-off from the top deck downslope into perimeter drainage channels. Each downdrain culvert is divided into two segments: the initial segment, sloped between three and five percent, provides a conduit through the headwall berm; run-off is then directed down the sideslope and into the perimeter channel by the second segment. Energy generated by water flowing in the downdrain at a 3:1 slope is dissipated by the corrugated metal pipe (CMP) t-section fitted to the bottom end of the downdrain. T-sections have been designed to handle both top deck flows and perimeter channel flows combined.

### **3.0 METHOD**

Drainage analyses were performed using the final grading plan depicted on Drawing 5 in Appendices A and M. The final closed surface of the landfill, as well as adjacent areas of land that will contribute run-on water to flow in the perimeter drainage channels, was divided into drainage sub-areas based on the final destination of run-off in a particular area. The site was divided into eight drainage areas, which were further divided into 23 sub-areas based on the proposed site design. The drainage sub-areas are illustrated on Drawing 9 in Appendices A and M, and on Figure J-1 at the end of this drainage report. To aid in drainage structure identification and comparison of results, the open channels and culverts that comprise the proposed drainage system are individually labeled on Drawing 9.

The United States Department of Agriculture, Soil Conservation Service TR-55 methodology (USDA, 1986) was used to calculate peak flood hydrographs for each of the drainage areas. The rainfall distribution in Utah is synthetically approximated by the Soil Conservation Service as a Type II pattern, which represents intense, short duration rainfall. Rainfall intensity data used in the TR-55 method were derived from the Precipitation Frequency Atlas of the United States - Volume VII - Nevada (NOAA, 1973). The 25-year, 24-hour storm depth used in the analyses was 2.4 inches.

Hydrologic soil groups within the drainage areas were identified using the Soil Survey of San Juan County, Utah, Central Part (USDA, 1993). Based on the information provided by the USDA Soil Survey and results of soils analysis in Appendix C, it was determined that local soils at the landfill could be conservatively modeled as a type "D" hydrologic soil. Descriptions of the hydrologic soil groups present at the site are attached at the end of this report. The cover type and hydrologic soil group classification were used to select the appropriate run-off curve number from Table 2-2d of TR-55 (USDA, 1986) to represent surface conditions at the site. This table has been attached at the end of this report. The area within the final waste footprint, which will receive a final cover layer, was conservatively assumed to be soil group D due to the final cover design with a shallow erosion layer underlain by an impervious clay layer. Although the closure plan calls for revegetation of the final cover, the analysis was conducted with the assumption that revegetation of the final cover will be "poor" due to the arid climate in the region.

Field observations indicate that the cover type outside the waste footprint is "sagebrush with grass understory" with a poor amount of grass cover in most places. This cover type and hydrologic soil group classification was used to select the appropriate run-off curve number from Table 2-2d. As a result, a run-off curve number of 85 was used for final landfill surfaces.

For modeling purposes, all open channels were assumed to be grass-lined, with a Manning's coefficient ( $n$ ) of 0.035 (also representative of rip-rap lined channels). All culverts were given a Manning's value of 0.024 for corrugated metal storm drains, based on information presented in Table 21-11 from Merritt (1983).

## 4.0 RESULTS

The attached output files from the TR-55 computer program illustrate the results of the drainage analyses for the proposed closure design. An analysis of the proposed final closure design, using the input parameters described above, resulted in predicted peak storm flows for drainage sub-areas 1 through 8. Tables J-1 and J-2, attached, summarize run-off from on-site and off-site sub-areas that contribute to each channel and culvert.

Drainage channels and culverts were sized using the FlowMaster computer program (Haestad, 1996). The resulting flow depths and velocities in each channel and culvert, as determined by the FlowMaster analysis, are summarized in the attached Table J-3. The run-off control system was designed to collect and control the peak flows resulting from a 25-year, 24-hour storm event. All drainage channels for on-site run-off not on the landfill top deck were conservatively sized to be 12- or 18-inch deep v-ditches with 3:1 sideslopes. All drainage channels that divert off-site run-on away from the landfill footprint were conservatively designed as 24-inch deep v-ditches with 3:1 sideslopes. TR-55 calculations predict a maximum flow of 9 cfs in any particular channel which could impact the final cover of the landfill. A series of data sheets from the FlowMaster analysis is attached to provide detailed information on the flow depth and velocity in each drainage channel at the predicted peak discharge and given slope grades included in the landfill design. The culvert and channel designations refer to the labeling system presented on Drawing 9.

All downdrain culverts were conservatively sized with a diameter of 18 inches to allow for convenient maintenance. T-sections at the ends of downdrains C2/2 and C3/1 were designed with a diameter of 24 inches to account for anticipated perimeter channel flows. Culverts under the perimeter access road were also designed with a diameter of 18 inches, with the exception of culvert C3,4, which was designed with a diameter of 24 inches to accommodate predicted flows from areas 3 and 4.

The off-site drainage areas east of the landfill (areas 7 and 8, see attached Figure J-1) were analyzed to determine the type of routing which will be required to divert storm flows around the waste mass. Based on the results, it has been determined that a conservatively-sized 24-inch-deep v-ditch will ensure that potential run-on flows will be diverted away from the waste mass.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the FlowMaster calculations attached with this appendix indicate that the proposed network of channels and culverts have been appropriately sized to collect and control the run-off resulting from a 25-year, 24-hour storm event. Channels with velocities greater than 4 feet per second (D6, D8, D9, and D14, Drawing 9) are recommended to receive rip-rap lining to prevent scouring and subsequent erosion. Rip-rap lining should also be placed in channel intersections and bends. Rip-rap should have a median diameter of 6 inches with a minimum average layer thickness of at least 9 inches.

Rip-rap protection should be installed completely around each culvert inlet and to a distance of at least ten feet downstream from each culvert outlet. Rip-rap inlet protection is especially important on the top deck around downdrain inlets and upstream from each inlet along the headwall diversion berms. Flared culvert end sections should be considered at downdrain inlets to further reduce the potential for erosion. Finally, a rip-rap discharge apron should extend a minimum of 20 feet downstream from the discharge point for channel D17 (Drawing 9) and 10 feet either side of the channel centerline to allow for energy dissipation before storm water flows are released into natural drainage channels southwest of the site.

Although flow velocities in top deck swales are not predicted to exceed 4 feet per second, peak storm flows are predicted to be in the supercritical range, indicating turbulence and scouring are possible at peak storm flows. Accordingly, rip-rap flow control berms are proposed at regular intervals in top deck swales to bring the effective channel slope to three percent. Rip-rap used in flow control berm construction should have a median diameter of 6 inches, a minimum average thickness of 9 inches, and be well-graded with no fines (-200 mesh). The berms will decrease the effective channel slope and reduce flow velocities to sub-critical flow levels. Berms should be constructed with rip-rap aprons extending a minimum of five feet upstream and downstream from the berm centerline to prevent scouring. The downstream apron should be constructed with a small stilling basin immediately downstream from the berm to further reduce potential channel velocities and turbulence.

Additional erosion protection such as rip-rap and/or erosion fabric is recommended along top deck access roads D20 and D26 (Drawing 9) to minimize the potential for erosion of the final cover. The use of erosion fabric and concentrated revegetation efforts along the entire length of all top deck and sideslope drainage channels should be considered to further reduce the potential for final cover erosion. Care should be taken during site revegetation efforts to ensure that channels and swales are given at least as much effort as the final landfill surface.

Although the hydraulic analysis also indicated supercritical flows in most sections of the perimeter drainage channels, erosion in these channels (constructed in native soils) does not pose an immediate threat to final cover integrity and may be easily mitigated or considered as part of the routine maintenance program. The entire drainage system should be inspected following significant



precipitation events, both during the operational life and the post-closure period. Necessary repairs to the system should be complete as soon as is practicable.

## **6.0 REFERENCES**

Haestad Methods, Inc., 1996, FlowMaster for Windows: Haestad Methods, Inc., Waterbury, Connecticut.

Merritt, F.S., 1983, Standard Handbook for Civil Engineers: Third edition, McGraw-Hill Book Company, New York.

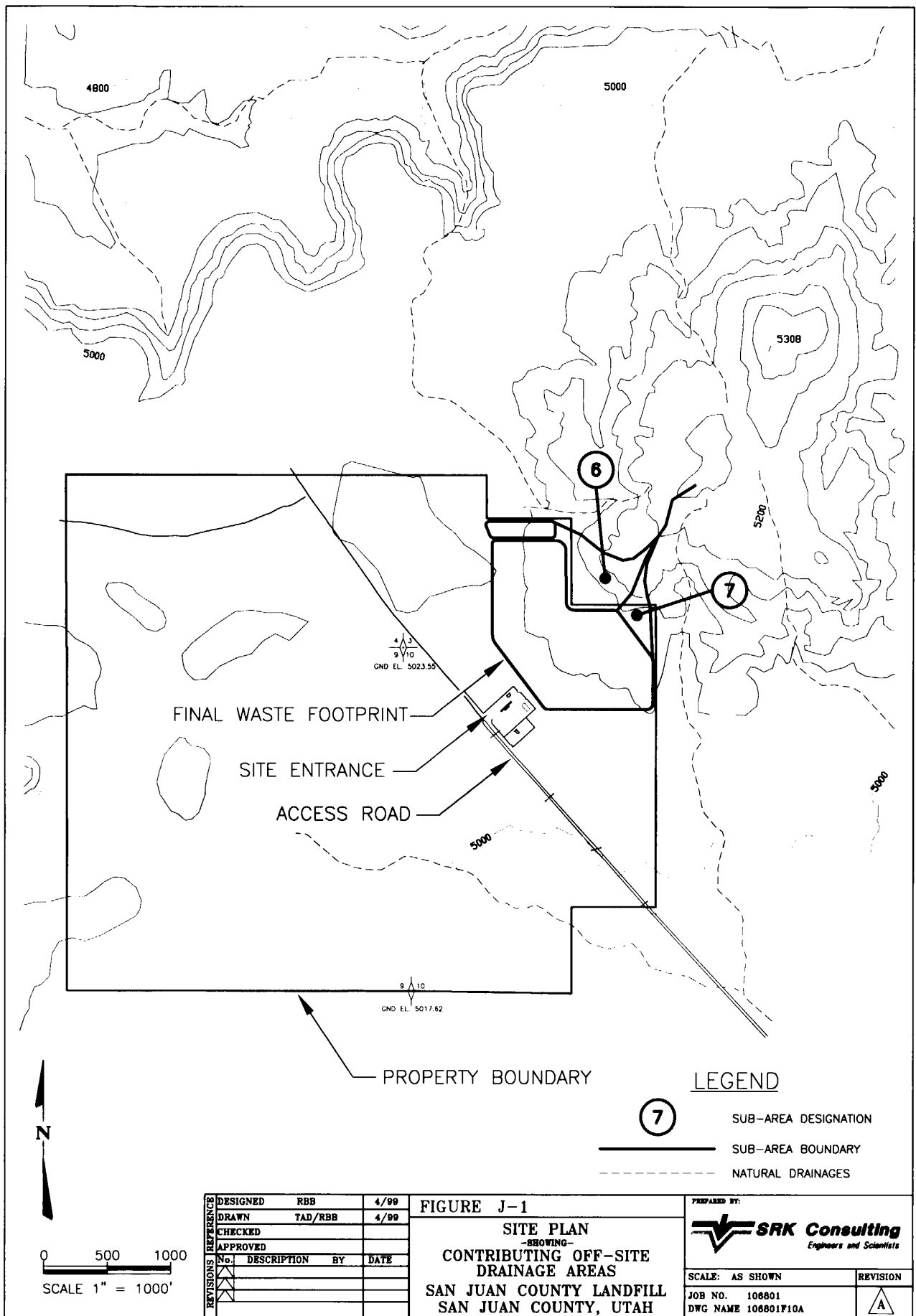
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United States Department of Agriculture, Soil Conservation Service, 1986, Urban hydrology for small watersheds: Engineering Division, Technical Release 55, Second Edition, June 1986.

United States Department of Agriculture, Soil Conservation Service, 1975, Standards and specifications for soil erosion and sediment control in developing areas, College Park, Maryland, June 1986.

## Figures



## **Summary of Results**

**TABLE J-1**  
**SUMMARY OF HYDROLOGIC ANALYSES**  
**Storm Water Run-Off from On-Site Drainage Areas**

Time Elapsed (1) (hr)	Estimated Run-Off Flows by Sub-Area for 25-Year, 24-Hour Event, in cfs																									
	Sub-Area 1						Sub-Area 2						Sub-Area 3					Sub-Area 4				Sub-Area 5				Sub-Area 6
	1A	1B	1C	1D	1E	Total	2A	2B	2C	2D	2E	Total	3A	3B	3C	3D	Total	4A	4B	4C	Total	5A	5B	5C	Total	
11.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.9	0	1	1	0	0	2	0	1	0	1	0	2	0	1	1	1	3	1	2	0	3	0	1	0	1	1
12.0	1	2	3	0	0	6	0	2	0	2	0	4	1	1	2	2	6	2	3	1	6	0	3	0	3	2
12.1	2	1	4	0	0	7	1	3	0	3	0	7	2	2	3	2	9	4	5	1	10	1	4	0	5	4
12.2	3	0	3	0	0	6	0	2	0	2	0	4	3	1	2	1	7	2	3	1	6	0	3	0	3	2
12.3	3	0	1	0	0	4	0	1	0	1	0	2	3	0	1	1	5	1	1	0	2	0	1	0	1	1
12.4	2	0	1	0	0	3	0	0	0	1	0	1	2	0	0	0	2	1	1	0	2	0	1	0	1	1
12.5	1	0	1	0	0	2	0	0	0	0	0	0	1	0	0	0	1	0	1	0	1	0	1	0	1	0
12.6	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	1	0	0	0	0	0
12.7	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
12.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peak	3	2	4	0	0	7	1	3	0	3	0	7	3	2	3	2	9	4	5	1	10	1	4	0	5	4

**TABLE J-2**  
**SUMMARY OF HYDROLOGIC ANALYSES**  
**Storm Water Run-On from Off-Site Drainage Areas**

Time Elapsed (1) (hr)	Estimated Run-On Flows by Sub-Area for 25-Year, 24-Hour Event, in cfs	
	Sub-Area 7	Sub-Area 8
11.0	0	0
11.3	0	0
11.6	0	0
11.9	3	1
12.0	5	2
12.1	9	3
12.2	5	2
12.3	2	1
12.4	1	0
12.5	1	0
12.6	1	0
12.7	1	0
12.8	1	0
13.0	1	0
13.2	1	0
13.4	0	0
13.6	0	0
13.8	0	0
<b>Peak</b>	<b>9</b>	<b>3</b>

Notes:

1. Time elapsed since beginning of storm event, in hours.
2. Complete results of each hydrograph are not included in this summary.
3. See attached data sheets for input and output details.

**TABLE J-3**  
**SUMMARY OF HYDRAULIC DESIGN**  
**San Juan County Landfill**

Description	Open Channel Flow								Closed Conduit Flow					
	Channel Number	Contributing Sub-Areas	Assumed Lining	Slope	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Design Depth (ft)	Culvert Number	Diameter (ft)	Limiting Slope	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)
Swale	D1	2b	Grass	4.0%	3	0.34	2.6	1.0						
Swale	D2	2d	Grass	4.0%	3	0.34	2.6	1.0						
Swale	D3	3c	Grass	6.0%	3	0.32	3.0	1.0						
Swale	D4	4b	Grass	4.3%	5	0.41	3.0	1.0						
Swale	D5	5b	Grass	4.3%	4	0.37	2.9	1.0						
V-Ditch	D6	8	Grass	6.7%	3	0.49	4.2	1.0						
V-Ditch	D7	7	Grass	2.4%	9	0.90	3.7	2.0						
V-Ditch	D8	7	Grass	5.0%	9	0.78	4.9	2.0						
V-Ditch	D9	6	Grass	6.7%	4	0.55	4.5	1.0						
V-Ditch	D10	6	Grass	3.0%	4	0.64	3.3	1.0						
V-Ditch	D11	1a	Grass	2.4%	3	0.59	2.8	1.0						
V-Ditch	D12	1a	Grass	5.0%	3	0.52	3.7	1.0						
V-Ditch	D13	1ab	Grass	4.0%	3	0.54	3.4	1.0						
V-Ditch	D14	1c	Grass	6.0%	4	0.56	4.3	1.0						
V-Ditch	D15	1c	Grass	4.0%	4	0.60	3.7	1.0						
V-Ditch	D16	1cde	Grass	2.0%	4	0.69	2.8	1.0						
V-Ditch	D17	1d	Grass	2.0%	0	0.41	2.0	1.0						
V-Ditch	D18	2a	Grass	1.3%	1	0.44	1.7	1.0						
V-Ditch	D19	2abc	Grass	1.3%	4	0.74	2.4	2.0						
V-Ditch	D20	3a	Grass	8.0%	3	0.47	4.4	1.0						
V-Ditch	D21	2abcde	Grass	1.0%	7	0.96	2.5	2.0						
V-Ditch	D22	3abcd	Grass	1.0%	9	1.06	2.7	2.0						
V-Ditch	D23	4abc	Grass	2.0%	10	0.97	3.6	2.0						
V-Ditch	D24	5abc	Grass	1.6%	5	0.78	2.8	2.0						
V-Ditch	D25	5a	Grass	1.6%	1	0.42	1.8	1.0						
V-Ditch	D26	4a	Grass	8.0%	4	0.53	4.8	1.0						
CMP Culvert	C1/1	1cd							C1/1	1.5	3.0%	4	0.67	5.3
CMP Culvert	C1/2	1abcde							C1/2	1.5	3.0%	7	0.93	6.1
CMP Culvert	C2/1	2b							C2/1	1.5	3.0%	3	0.57	4.9
CMP Culvert	C2/1T	2ab							C2/1T	1.5	1.3%	3	0.72	3.6
CMP Culvert	C2/2	2d							C2/2	1.5	3.0%	3	0.57	4.9
CMP Culvert	C2/2T	2abcd							C2/2T	2.0	1.3%	7	1.00	4.5
CMP Culvert	C2/3	2abcde							C2/3	1.5	3.0%	7	0.93	6.1
CMP Culvert	C3/1	3c							C3/1	1.5	3.0%	3	0.57	4.9
CMP Culvert	C3/1T	3abc							C3/1T	2.0	1.0%	9	1.27	4.3
CMP Culvert	C3.4	3abcd 4abc							C3.4	2.0	3.0%	19	1.48	7.6
CMP Culvert	C4/1	4b							C4/1	1.5	3.0%	5	0.76	5.6
CMP Culvert	C4/1T	4ab							C4/1T	2.0	2.0%	9	1.02	5.6
CMP Culvert	C5/1	5b							C5/1	1.5	3.0%	4	0.67	5.3
CMP Culvert	C5/1T	5ab							C5/1T	2.0	1.6%	5	0.78	4.4
CMP Culvert	C5/2	5abc							C5/2	1.5	3.0%	5	0.76	5.6
CMP Culvert	C6	6							C6	1.5	3.0%	4	0.67	5.3

**Notes:**

1. Refer to Drawing 8 and Figure 10-1 for channel and culvert designations.
2. See attached TR-55 and Flowmaster data sheets for input and output details.



**Hydrologic Soil Group Descriptions  
(USDA, 1993)**

**Table 2-2d  
(USDA, 1986)**

Recapture—alkali sacaton, galleta, seepweed, bottlebrush squirreltail, and black greasewood

*General management considerations:*

- The suitability for range seeding is very poor because of the low annual precipitation, the limited depth to bedrock or clay layers in the Moenkopie and Littlenan soils, and the sodicity of the Recapture soil.
- Trafficability over unsurfaced roads is poor because of the high content of clay in the subsoil of the Littlenan soil.
- The Littlenan soil is a possible source of clay material for sealing ponds and embankments. Disturbed areas are difficult to reclaim.

*Suitable management practices:*

- Proper grazing use, a planned grazing system, and properly distributed water developments can maintain or improve the rangeland vegetation.
- During periods of severe drought, partial or total removal of livestock may be necessary to protect the perennial vegetation.

**Land Capability Classification**

*Capability subclass:* VIIs, nonirrigated

**19—Littlenan-Ruinpoint-Rizno association, 1 to 20 percent slopes**

**Setting**

*Position on landscape:* Structural benches and fan terraces

*Native plants:* Trees, shrubs, and grasses

*Elevation:* 4,800 to 5,600 feet

**Composition**

Littlenan soil and similar inclusions: 35 percent

Ruinpoint soil and similar inclusions: 20 percent

Rizno soil and similar inclusions: 20 percent

Contrasting inclusions: 25 percent

**Characteristics of the Littlenan Soil**

*Position on landscape:* Structural benches below the Rizno soil; underlain by shale bedrock

*Slope range:* 3 to 20 percent

*Slope features:* Shape—convex; length—10 to 20 feet

*Typical profile:*

0 to 3 inches—light brown gravelly loam

3 to 14 inches—light brown silty clay loam

14 to 29 inches—light brown silty clay

29 inches—weathered shale bedrock

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Permeability:* Slow

*Available water capacity:* Moderately low or moderate

*Water-supplying capacity:* Low or moderate

*Potential rooting depth:* 20 to 40 inches

*Organic matter content in the surface layer:* Very low

*Runoff:* Rapid

*Hazard of water erosion:* Moderate

*Hazard of wind erosion:* Moderate

**Characteristics of the Ruinpoint Soil**

*Position on landscape:* Concave slopes on structural benches; intermixed with areas of the Littlenan soil

*Slope range:* 1 to 8 percent

*Slope features:* Shape—concave; length—40 to 80 feet

*Typical profile:*

0 to 2 inches—yellowish red very fine sandy loam

2 to 13 inches—yellowish red silt loam

13 to 60 inches—reddish yellow silt loam

*Depth class:* Very deep

*Drainage class:* Well drained

*Permeability:* Moderate

*Available water capacity:* Moderately high or high

*Water-supplying capacity:* Moderate

*Potential rooting depth:* More than 60 inches

*Organic matter content in the surface layer:* Low

*Runoff:* Slow

*Hazard of water erosion:* Moderate

*Hazard of wind erosion:* Severe

**Characteristics of the Rizno Soil**

*Position on landscape:* Structural benches above the Littlenan and Ruinpoint soils; underlain by sandstone bedrock

*Slope range:* 3 to 15 percent

*Slope features:* Shape—convex; length—less than 10 feet

*Typical profile:*

0 to 3 inches—reddish brown fine sandy loam

3 to 13 inches—reddish brown fine sandy loam

13 inches—sandstone bedrock

*Depth class:* Shallow

*Drainage class:* Well drained

*Permeability:* Moderately rapid

*Available water capacity:* Very low

*Water-supplying capacity:* Very low or low

*Potential rooting depth:* 10 to 20 inches

*Organic matter content in the surface layer:* Very low

*Runoff:* Medium

*Hazard of water erosion:* Moderate

*Hazard of wind erosion:* Severe

**Contrasting Inclusions**

- About 10 percent very deep, loamy soils that support black greasewood and alkali sacaton
- About 10 percent deep, stony soils that are on steep hillsides and that support pinyon and Utah juniper
- About 5 percent very deep, loamy soils that are on the

lower structural benches and that support fourwing saltbush, needleandthread, and Indian ricegrass

### **Major Current Uses**

Rangeland, recreation, and wildlife habitat

### **Major Management Factors**

#### **Soil-related factors**

A high content of clay, a high shrink-swell potential, and a limited depth to bedrock

#### **Climate-related factors**

*Average annual precipitation:* 8 to 12 inches

*Mean annual air temperature:* 49 to 53 degrees F

*Frost-free period:* 130 to 160 days

### **Rangeland**

#### **Littlenan**

*Range site:* Alkali Fan (Castle Valley Saltbush)

*Composition of the potential plant community:* 35 percent grasses, 10 percent forbs, and 55 percent shrubs

*Important plants:* Galleta, Indian ricegrass, shadscale, and Castle Valley saltbush

#### **Ruinpoint**

*Range site:* Semidesert Loam (Wyoming Big Sagebrush)

*Composition of the potential plant community:* 45 percent grasses, 10 percent forbs, and 45 percent shrubs

*Important plants:* Indian ricegrass, galleta, bottlebrush squirreltail, winterfat, and Wyoming big sagebrush

### **Woodland**

#### **Rizno**

*Woodland site:* Semidesert Shallow Loam (Utah Juniper-Pinyon)

*Overstory canopy:* 30 percent, consisting of Utah juniper and pinyon

*Composition of the understory vegetation:* 45 percent grasses, 10 percent forbs, and 45 percent shrubs

*Important plants:* Indian ricegrass, Mexican cliffrose, galleta, and bottlebrush squirreltail

*Site index:* 20 for Utah juniper and pinyon

*Average productivity:* Low

*Average yield per acre:* 3.5 cords

*Potential for post or Christmas tree production:* Poor

### **General Management Considerations**

- The suitability for range seeding is very poor because of the low annual precipitation, the limited depth to bedrock, and the high content of clay.
- Trafficability over unsurfaced roads is poor because of the high content of clay in the subsoil of the Littlenan soil.
- The Littlenan soil is a possible source of clay material

for sealing ponds and embankments. Disturbed areas are difficult to reclaim.

### **Suitable Management Practices**

- Proper grazing use, a planned grazing system, and properly distributed water developments can maintain or improve the rangeland vegetation.
- During periods of severe drought, partial or total removal of livestock may be necessary to protect the perennial vegetation.

### **Land Capability Classification**

#### **Capability subclass:**

Littlenan soil—VIIe, nonirrigated

Ruinpoint soil—VIIe, nonirrigated

Rizno soil—VIIs, nonirrigated

## **20—Mido-Riverwash complex**

### **Setting**

*Position on landscape:* Structural benches and canyon floors

*Slope range:* 2 to 15 percent

*Native plants:* Shrubs and grasses

*Elevation:* 5,200 to 5,700 feet

### **Composition**

Mido soil and similar inclusions: 70 percent

Riverwash: 20 percent

Contrasting inclusions: 10 percent

### **Characteristics of the Mido Soil**

*Position on landscape:* Stabilized dunes; on structural benches in canyons intermixed with areas of Riverwash

*Slope range:* 2 to 15 percent

*Slope features:* Shape—convex; length—20 to 40 feet

*Typical profile:*

0 to 10 inches—red loamy fine sand

10 to 60 inches—red loamy fine sand

*Depth class:* Very deep

*Drainage class:* Excessively drained

*Permeability:* Rapid

*Available water capacity:* Low or moderate

*Water-supplying capacity:* Low or moderate

*Potential rooting depth:* More than 60 inches

*Organic matter content in the surface layer:* Very low

*Runoff:* Very slow

*Hazard of water erosion:* Slight

*Hazard of wind erosion:* Severe

### **Characteristics of Riverwash**

- Riverwash consists of sandy and loamy material that

Table 2-2d.—Runoff curve numbers for arid and semiarid rangelands<sup>1</sup>

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition <sup>2</sup>	A <sup>3</sup>	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

<sup>1</sup>Average runoff condition, and  $I_a = 0.2S$ . For range in humid regions, use table 2-2c.

<sup>2</sup>Poor: <30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: >70% ground cover.

<sup>3</sup>Curve numbers for group A have been developed only for desert shrub.

## **TR-55 Results - Final Site Conditions**

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 1 (a and b)

Subarea : 1A

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	2.4 (85)

Total Area (by Hydrologic Soil Group)

2.4  
====

SUBAREA: 1A      TOTAL DRAINAGE AREA: 2.4 Acres      WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 1 (a and b)

Subarea : 1B

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	1.1(85)

Total Area (by Hydrologic Soil Group)

1.1

====

SUBAREA: 1B      TOTAL DRAINAGE AREA: 1.1 Acres      WEIGHTED CURVE NUMBER: 85

## TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 1 (a and b)

```

----- Subarea #1 - 1A -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code                (sq/ft) (ft)  (ft/sec) (hr)
-----
Sheet         1.2        90        0.33      a                                0.010
Open Channel              900                                2.6    0.096
Open Channel              160                                3.6    0.012
                                           Time of Concentration = 0.12*
                                           =====

```

```

Open Channel              900                                2.6    0.096
Open Channel              160                                3.6    0.012
                                           Travel Time = 0.11*
                                           =====

```

```

----- Subarea #2 - 1B -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code                (sq/ft) (ft)  (ft/sec) (hr)
-----
Sheet         1.2        65        0.33      a                                0.008
Open Channel              510                                3.2    0.044
                                           Time of Concentration = 0.05*
                                           =====

Open Channel              510                                3.2    0.044
                                           Travel Time = 0.04*
                                           =====

```

## --- Sheet Flow Surface Codes ---

```

A Smooth Surface      F Grass, Dense
B Fallow (No Res.)    G Grass, Bermuda
C Cultivated < 20 % Res. H Woods, Light
D Cultivated > 20 % Res. I Woods, Dense
E Grass-Range, Short   J Range, Natural

```

```

--- Shallow Concentrated ---
--- Surface Codes ---
P Paved
U Unpaved

```

\* - Generated for use by TABULAR method



TABULAR HYDROGRAPH METHOD

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 1 (a and b)

Total watershed area: 0.005 sq mi Rainfall type: II Frequency: 25 years

	----- Subareas -----	
	1A	1B
Area(sq mi)	0.00*	0.00*
Rainfall(in)	2.4	2.4
Curve number	85*	85*
Runoff(in)	1.10	1.10
Tc (hrs)	0.12*	0.05*
(Used)	0.10	0.10
TimeToOutlet	0.04*	0.00
(Used)	0.10	0.00
Ia/P	0.15	0.15

Time (hr)	Total Flow	----- Subarea Contribution to Total Flow (cfs) -----	
		1A	1B
11.0	0	0	0
11.3	0	0	0
11.6	0	0	0
11.9	1	0	1
12.0	2	1	1
12.1	4P	2	2P
12.2	4	3P	1
12.3	3	3	0
12.4	2	2	0
12.5	1	1	0
12.6	1	1	0
12.7	1	1	0
12.8	0	0	0
13.0	0	0	0
13.2	0	0	0
13.4	0	0	0
13.6	0	0	0
13.8	0	0	0
14.0	0	0	0
14.3	0	0	0
14.6	0	0	0
15.0	0	0	0
15.5	0	0	0
16.0	0	0	0
16.5	0	0	0
17.0	0	0	0
17.5	0	0	0
18.0	0	0	0
19.0	0	0	0
20.0	0	0	0
22.0	0	0	0
26.0	0	0	0

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 1 (c,d,e)

Subarea : 1C

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	2.5 (85)

Total Area (by Hydrologic Soil Group)

2.5

====

SUBAREA: 1C TOTAL DRAINAGE AREA: 2.5 Acres WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 1 (c,d,e)

Subarea : 1D

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	0.1(85)

Total Area (by Hydrologic Soil Group)

.1

====

SUBAREA: 1D

TOTAL DRAINAGE AREA: .1 Acres

WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 1 (c,d,e)

Subarea : 1E

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	0.1 (85)

Total Area (by Hydrologic Soil Group)

.1

====

SUBAREA: 1E TOTAL DRAINAGE AREA: .1 Acres

WEIGHTED CURVE NUMBER: 85

## TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County  
Subtitle: Sub-area 1 (c,d,e)

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

```

----- Subarea #1 - 1C -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)   (hr)
-----
Sheet        1.2        175        0.33      a
Open Channel              100
Open Channel              510

```

Time of Concentration = 0.07\*

=====

```

Open Channel              100
Open Channel              510

```

Travel Time = 0.05\*

=====

```

----- Subarea #2 - 1D -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)   (hr)
-----
Sheet        1.2        125        0.33      a
Open Channel              110

```

Time of Concentration = 0.03

=====

```

Open Channel              110

```

Travel Time = 0.01\*

=====

```

----- Subarea #3 - 1E -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)   (hr)
-----
Sheet        1.2        50        0.33      a
Open Channel              120

```

Time of Concentration = 0.02\*

=====

```

Open Channel              120

```

Travel Time = 0.01\*

=====

## --- Sheet Flow Surface Codes ---

```

A Smooth Surface      F Grass, Dense
B Fallow (No Res.)    G Grass, Burmuda
C Cultivated < 20 % Res. H Woods, Light
D Cultivated > 20 % Res. I Woods, Dense
E Grass-Range, Short   J Range, Natural

```

```

--- Shallow Concentrated ---
--- Surface Codes ---
P Paved
U Unpaved

```

\* - Generated for use by TABULAR method

TABULAR HYDROGRAPH METHOD

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 1 (c,d,e)

Total watershed area: 0.004 sq mi Rainfall type: II Frequency: 25 years

----- Subareas -----

	1C	1D	1E
Area(sq mi)	0.00*	0.00*	0.00*
Rainfall(in)	2.4	2.4	2.4
Curve number	85*	85*	85*
Runoff(in)	1.10	1.10	1.10
Tc (hrs)	0.07*	0.03*	0.02*
(Used)	0.10	0.10	0.10
TimeToOutlet	0.01*	0.01*	0.00
(Used)	0.00	0.00	0.00
Ia/P	0.15	0.15	0.15

Time (hr)	Total Flow	1C	1D	1E
11.0	0	0	0P	0P
11.3	0	0	0	0
11.6	0	0	0	0
11.9	1	1	0	0
12.0	3	3	0	0
12.1	4P	4P	0	0
12.2	3	3	0	0
12.3	1	1	0	0
12.4	1	1	0	0
12.5	1	1	0	0
12.6	0	0	0	0
12.7	0	0	0	0
12.8	0	0	0	0
13.0	0	0	0	0
13.2	0	0	0	0
13.4	0	0	0	0
13.6	0	0	0	0
13.8	0	0	0	0
14.0	0	0	0	0
14.3	0	0	0	0
14.6	0	0	0	0
15.0	0	0	0	0
15.5	0	0	0	0
16.0	0	0	0	0
16.5	0	0	0	0
17.0	0	0	0	0
17.5	0	0	0	0
18.0	0	0	0	0
19.0	0	0	0	0
20.0	0	0	0	0
22.0	0	0	0	0
26.0	0	0	0	0

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 2 (a,b,c,d,e)

Subarea : 2a

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			

ARID AND SEMIARID RANGELANDS

Sagebrush (w/ grass understory) poor	-	-	-	0.3 (85)
--------------------------------------	---	---	---	----------

Total Area (by Hydrologic Soil Group)

.3  
===

SUBAREA: 2a TOTAL DRAINAGE AREA: .3 Acres

WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 2 (a,b,c,d,e)

Subarea : 2b

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	1.5 (85)

Total Area (by Hydrologic Soil Group)

1.5  
==

SUBAREA: 2b TOTAL DRAINAGE AREA: 1.5 Acres WEIGHTED CURVE NUMBER: 85



# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 2 (a,b,c,d,e)

Subarea : 2c

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	0.2(85)

Total Area (by Hydrologic Soil Group)

.2

====

SUBAREA: 2c

TOTAL DRAINAGE AREA: .2 Acres

WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 2 (a,b,c,d,e)

Subarea : 2d

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	2.0 (85)

Total Area (by Hydrologic Soil Group)

2

====

SUBAREA: 2d TOTAL DRAINAGE AREA: 2 Acres

WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 2 (a,b,c,d,e)

Subarea : 2e

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	0.1 (85)

Total Area (by Hydrologic Soil Group)

.1  
====

SUBAREA: 2e

TOTAL DRAINAGE AREA: .1 Acres

WEIGHTED CURVE NUMBER: 85

## TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 2 (a,b,c,d,e)

```

----- Subarea #1 - 2a -----
Flow Type   2 year   Length   Slope   Surface   n   Area   Wp   Velocity   Time
              rain      (ft)    (ft/ft)  code      (sq/ft) (ft)  (ft/sec)  (hr)
-----
Sheet        1.2      100      0.33     a                      0.011
Open Channel              190                      1.65  0.032
                                           Time of Concentration = 0.04*
                                           =====

```

```

Open Channel          190                      1.65  0.032
                                           Travel Time = 0.03*
                                           =====

```

```

----- Subarea #2 - 2b -----
Flow Type   2 year   Length   Slope   Surface   n   Area   Wp   Velocity   Time
              rain      (ft)    (ft/ft)  code      (sq/ft) (ft)  (ft/sec)  (hr)
-----
Sheet        1.2      200      0.33     a                      0.019
Open Channel              380                      3.2   0.033
                                           Time of Concentration = 0.05*
                                           =====

```

```

Open Channel          380                      3.2   0.033
                                           Travel Time = 0.03*
                                           =====

```

```

----- Subarea #3 - 2c -----
Flow Type   2 year   Length   Slope   Surface   n   Area   Wp   Velocity   Time
              rain      (ft)    (ft/ft)  code      (sq/ft) (ft)  (ft/sec)  (hr)
-----
Sheet        1.2      50       0.33     a                      0.006
Open Channel              280                      1.65  0.047
                                           Time of Concentration = 0.05*
                                           =====

```

```

Open Channel          280                      1.65  0.047
                                           Travel Time = 0.05*
                                           =====

```

\* - Generated for use by TABULAR method

## TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 2 (a,b,c,d,e)

```

----- Subarea #4 - 2d -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)  (hr)
-----
Sheet         1.2        230        0.33      a
Open Channel          370
                                           3.2      0.032
Time of Concentration = 0.05*
=====

```

```

Open Channel          370                                           3.2      0.032
Travel Time = 0.03*
=====

```

```

----- Subarea #5 - 2e -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)  (hr)
-----
Sheet         1.2        50         .33      a
Open Channel          190
                                           1.6      0.033
Time of Concentration = 0.04*
=====

```

```

Open Channel          190                                           1.6      0.03
Travel Time = 0.03*
=====

```

## --- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense
B Fallow (No Res.)	G Grass, Burmuda
C Cultivated < 20 % Res.	H Woods, Light
D Cultivated > 20 % Res.	I Woods, Dense
E Grass-Range, Short	J Range, Natural

```

--- Shallow Concentrated ---
--- Surface Codes ---
P Paved
U Unpaved

```

\* - Generated for use by TABULAR method

TABULAR HYDROGRAPH METHOD

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 2 (a,b,c,d,e)

Total watershed area: 0.006 sq mi Rainfall type: II Frequency: 25 years

----- Subareas -----						
	2a	2b	2c	2d	2e	
Area(sq mi)	0.00*	0.00*	0.00*	0.00*	0.00*	
Rainfall(in)	2.4	2.4	2.4	2.4	2.4	
Curve number	85*	85*	85*	85*	85*	
Runoff(in)	1.10	1.10	1.10	1.10	1.10	
Tc (hrs)	0.04*	0.05*	0.05*	0.05*	0.04*	
(Used)	0.10	0.10	0.10	0.10	0.10	
TimeToOutlet	0.08*	0.08*	0.03*	0.03*	0.00	
(Used)	0.00	0.00	0.00	0.00	0.00	
Ia/P	0.15	0.15	0.15	0.15	0.15	
Time (hr)	Total Flow	2a	2b	2c	2d	2e
11.0	0	0	0	0P	0	0P
11.3	0	0	0	0	0	0
11.6	0	0	0	0	0	0
11.9	2	0	1	0	1	0
12.0	4	0	2	0	2	0
12.1	7P	1P	3P	0	3P	0
12.2	4	0	2	0	2	0
12.3	2	0	1	0	1	0
12.4	1	0	0	0	1	0
12.5	0	0	0	0	0	0
12.6	0	0	0	0	0	0
12.7	0	0	0	0	0	0
12.8	0	0	0	0	0	0
13.0	0	0	0	0	0	0
13.2	0	0	0	0	0	0
13.4	0	0	0	0	0	0
13.6	0	0	0	0	0	0
13.8	0	0	0	0	0	0
14.0	0	0	0	0	0	0
14.3	0	0	0	0	0	0
14.6	0	0	0	0	0	0
15.0	0	0	0	0	0	0
15.5	0	0	0	0	0	0
16.0	0	0	0	0	0	0
16.5	0	0	0	0	0	0
17.0	0	0	0	0	0	0
17.5	0	0	0	0	0	0
18.0	0	0	0	0	0	0
18.3	0	0	0	0	0	0
20.0	0	0	0	0	0	0
22.0	0	0	0	0	0	0
26.0	0	0	0	0	0	0

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 3 (a,b,c,d)

Subarea : 3a

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	2.4 (85)

Total Area (by Hydrologic Soil Group)

2.4

====

SUBAREA: 3a TOTAL DRAINAGE AREA: 2.4 Acres WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 3 (a,b,c,d)

Subarea : 3b

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	1.2 (85)

Total Area (by Hydrologic Soil Group)

1.2  
====

SUBAREA: 3b      TOTAL DRAINAGE AREA: 1.2 Acres      WEIGHTED CURVE NUMBER: 85



# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 3 (a,b,c,d)

Subarea : 3c

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	1.7(85)

Total Area (by Hydrologic Soil Group)

1.7  
====

SUBAREA: 3c TOTAL DRAINAGE AREA: 1.7 Acres WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 3 (a,b,c,d)

Subarea : 3d

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	1.4 (85)

Total Area (by Hydrologic Soil Group)

1.4  
====

SUBAREA: 3d TOTAL DRAINAGE AREA: 1.4 Acres WEIGHTED CURVE NUMBER: 85

## TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 3 (a,b,c,d)

```

----- Subarea #1 - 3a -----
Flow Type   2 year   Length   Slope   Surface   n   Area   Wp   Velocity   Time
            rain      (ft)    (ft/ft)  code      (sq/ft) (ft)  (ft/sec)  (hr)
-----
Sheet       1.2       130      0.33     a                0.013
Open Channel      670                4.6       0.040
                                           Time of Concentration = 0.05*
                                           =====

Open Channel      670                4.6       0.040
                                           Travel Time = 0.04*
                                           =====

```

```

----- Subarea #2 - 3b -----
Flow Type   2 year   Length   Slope   Surface   n   Area   Wp   Velocity   Time
            rain      (ft)    (ft/ft)  code      (sq/ft) (ft)  (ft/sec)  (hr)
-----
Sheet       1.2       200      0.33     a                0.019
Open Channel      335                1.6       0.058
                                           Time of Concentration = 0.08*
                                           =====

Open Channel      335                1.6       0.050
                                           Travel Time = 0.06*
                                           =====

```

```

----- Subarea #3 - 3c -----
Flow Type   2 year   Length   Slope   Surface   n   Area   Wp   Velocity   Time
            rain      (ft)    (ft/ft)  code      (sq/ft) (ft)  (ft/sec)  (hr)
-----
Sheet       1.2       130      0.33     a                0.013
Open Channel      320                3.9       0.023
                                           Time of Concentration = 0.04*
                                           =====

Open Channel      320                3.9       0.023
                                           Travel Time = 0.02*
                                           =====

```

\* - Generated for use by TABULAR method

## TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 3 (a,b,c,d)

----- Subarea #4 - 3d -----

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.2	180	0.33	a					0.017
Open Channel		335						1.6	0.058
Time of Concentration = 0.08*									=====
Open Channel		335						1.6	0.058
Travel Time = 0.06*									=====

## --- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense
B Fallow (No Res.)	G Grass, Burmuda
C Cultivated < 20 % Res.	H Woods, Light
D Cultivated > 20 % Res.	I Woods, Dense
E Grass-Range, Short	J Range, Natural

--- Shallow Concentrated ---  
--- Surface Codes ---  
P Paved  
U Unpaved

\* Generated for use by TABULAR method

TABULAR HYDROGRAPH METHOD

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 3 (a,b,c,d)

Total watershed area: 0.010 sq mi Rainfall type: II Frequency: 25 years

	Subareas			
	3a	3b	3c	3d
Area(sq mi)	0.00*	0.00*	0.00*	0.00*
Rainfall(in)	2.4	2.4	2.4	2.4
Curve number	85*	85*	85*	85*
Runoff(in)	1.10	1.10	1.10	1.10
Tc (hrs)	0.05*	0.08*	0.04*	0.08*
(Used)	0.10	0.10	0.10	0.10
TimeToOutlet	0.12*	0.06*	0.06*	0.00
(Used)	0.10	0.00	0.00	0.00
Ia/P	0.15	0.15	0.15	0.15

Time (hr)	Total Flow	Subarea Contribution to Total Flow (cfs)			
		3a	3b	3c	3d
11.0	0	0	0	0	0
11.3	0	0	0	0	0
11.6	0	0	0	0	0
11.9	3	0	1	1	1
12.0	6	1	1	2	2P
12.1	9P	2	2P	3P	2
12.2	7	3P	1	2	1
12.3	5	3	0	1	1
12.4	2	2	0	0	0
12.5	1	1	0	0	0
12.6	1	1	0	0	0
12.7	1	1	0	0	0
12.8	0	0	0	0	0
13.0	0	0	0	0	0
13.2	0	0	0	0	0
13.4	0	0	0	0	0
13.6	0	0	0	0	0
13.8	0	0	0	0	0
14.0	0	0	0	0	0
14.3	0	0	0	0	0
14.6	0	0	0	0	0
15.0	0	0	0	0	0
15.5	0	0	0	0	0
16.0	0	0	0	0	0
16.5	0	0	0	0	0
17.0	0	0	0	0	0
17.5	0	0	0	0	0
18.0	0	0	0	0	0
19.0	0	0	0	0	0
20.0	0	0	0	0	0
22.0	0	0	0	0	0
26.0	0	0	0	0	0

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 4 (a,b,c)

Subarea : 4a

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	2.2 (85)

Total Area (by Hydrologic Soil Group)

2.2

====

SUBAREA: 4a TOTAL DRAINAGE AREA: 2.2 Acres WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 4 (a,b,c)

Subarea : 4b

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	3.0 (85)

Total Area (by Hydrologic Soil Group)

3

====

SUBAREA: 4b

TOTAL DRAINAGE AREA: 3 Acres

WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 4 (a,b,c)

Subarea : 4c

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	0.8(85)

Total Area (by Hydrologic Soil Group)

.8

====

SUBAREA: 4c

TOTAL DRAINAGE AREA: .8 Acres

WEIGHTED CURVE NUMBER: 85



## TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 4 (a,b,c)

```

----- Subarea #1 - 4a -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)   (hr)
-----
Sheet         1.2        140        0.33      a
Open Channel              630
                                     4.6      0.038
Time of Concentration = 0.05*
=====

```

```

Open Channel              630                                     4.6      0.038
Travel Time = 0.04*
=====

```

```

----- Subarea #2 - 4b -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)   (hr)
-----
Sheet         1.2        250        0.33      a
Open Channel              550
                                     3.3      0.046
Time of Concentration = 0.07*
=====

```

```

Open Channel              550                                     3.3      0.046
Travel Time = 0.05*
=====

```

```

----- Subarea #3 - 4c -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)   (hr)
-----
Sheet         1.2        170        0.33      a
Open Channel              250
                                     2.25     0.031
Time of Concentration = 0.05*
=====

```

```

Open Channel              250                                     2.25     0.031
Travel Time = 0.03*
=====

```

## --- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense
B Fallow (No Res.)	G Grass, Burmuda
C Cultivated < 20 % Res.	H Woods, Light
D Cultivated > 20 % Res.	I Woods, Dense
E Grass-Range, Short	J Range, Natural

```

--- Shallow Concentrated ---
--- Surface Codes ---
P Paved
U Unpaved

```

\* - Generated for use by TABULAR method

TABULAR HYDROGRAPH METHOD

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 4 (a,b,c)

Total watershed area: 0.009 sq mi Rainfall type: II Frequency: 25 years

----- Subareas -----

	4a	4b	4c
Area(sq mi)	0.00*	0.00*	0.00*
Rainfall(in)	2.4	2.4	2.4
Curve number	85*	85*	85*
Runoff(in)	1.10	1.10	1.10
Tc (hrs)	0.05*	0.07*	0.05*
(Used)	0.10	0.10	0.10
TimeToOutlet	0.03*	0.03*	0.00
(Used)	0.00	0.00	0.00
Ia/P	0.15	0.15	0.15

Time Total ----- Subarea Contribution to Total Flow (cfs) -----  
(hr) Flow 4a 4b 4c

11.0	0	0	0	0
11.3	0	0	0	0
11.6	0	0	0	0
11.9	3	1	2	0
12.0	6	2	3	1P
12.1	10P	4P	5P	1
12.2	6	2	3	1
12.3	2	1	1	0
12.4	2	1	1	0
12.5	1	0	1	0
12.6	1	0	1	0
12.7	0	0	0	0
12.8	0	0	0	0
13.0	0	0	0	0
13.2	0	0	0	0
13.4	0	0	0	0
13.6	0	0	0	0
13.8	0	0	0	0
14.0	0	0	0	0
14.3	0	0	0	0
14.6	0	0	0	0
15.0	0	0	0	0
15.5	0	0	0	0
16.0	0	0	0	0
16.5	0	0	0	0
17.0	0	0	0	0
17.5	0	0	0	0
18.0	0	0	0	0
18.3	0	0	0	0
20.0	0	0	0	0
22.0	0	0	0	0
26.0	0	0	0	0

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 5 (a,b,c)

Subarea : 5a

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	0.3 (85)

Total Area (by Hydrologic Soil Group)

.3

====

SUBAREA: 5a

TOTAL DRAINAGE AREA: .3 Acres

WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 5 (a,b,c)

Subarea : 5b

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	2.6 (85)

Total Area (by Hydrologic Soil Group)

2.6  
====

SUBAREA: 5b      TOTAL DRAINAGE AREA: 2.6 Acres      WEIGHTED CURVE NUMBER: 85

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 5 (a,b,c)

Subarea : 5c

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	0.1(85)

Total Area (by Hydrologic Soil Group)

.1  
===

SUBAREA: 5c

TOTAL DRAINAGE AREA: .1 Acres

WEIGHTED CURVE NUMBER: 85

## TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 5 (a,b,c)

```

----- Subarea #1 - 5a -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)   (hr)
-----
Sheet         1.2        80        0.33      a
Open Channel          230
Time of Concentration = 0.04*
=====

```

```

Open Channel          230
Travel Time = 0.03*
=====

```

```

----- Subarea #2 - 5b -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)   (hr)
-----
Sheet         1.2        250       0.33      a
Open Channel          500
Time of Concentration = 0.06*
=====

```

```

Open Channel          500
Travel Time = 0.04*
=====

```

```

----- Subarea #3 - 5c -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)   (hr)
-----
Sheet         1.2        40        0.33      a
Open Channel          230
Time of Concentration = 0.04*
=====

```

```

Open Channel          230
Travel Time = 0.03*
=====

```

## --- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense
B Fallow (No Res.)	G Grass, Burmuda
C Cultivated < 20 % Res.	H Woods, Light
D Cultivated > 20 % Res.	I Woods, Dense
E Grass-Range, Short	J Range, Natural

```

--- Shallow Concentrated ---
--- Surface Codes ---
P Paved
U Unpaved

```

\* - Generated for use by TABULAR method

TABULAR HYDROGRAPH METHOD

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 5 (a,b,c)

Total watershed area: 0.005 sq mi Rainfall type: II Frequency: 25 years

	5a	5b	5c
Area(sq mi)	0.00*	0.00*	0.00*
Rainfall(in)	2.4	2.4	2.4
Curve number	85*	85*	85*
Runoff(in)	1.10	1.10	1.10
Tc (hrs)	0.04*	0.06*	0.04*
(Used)	0.10	0.10	0.10
TimeToOutlet	0.03*	0.03*	0.00
(Used)	0.00	0.00	0.00
Ia/P	0.15	0.15	0.15

Time (hr)	Total Flow	5a	5b	5c
11.0	0	0	0	0P
11.3	0	0	0	0
11.6	0	0	0	0
11.9	1	0	1	0
12.0	3	0	3	0
12.1	5P	1P	4P	0
12.2	3	0	3	0
12.3	1	0	1	0
12.4	1	0	1	0
12.5	1	0	1	0
12.6	0	0	0	0
12.7	0	0	0	0
12.8	0	0	0	0
13.0	0	0	0	0
13.2	0	0	0	0
13.4	0	0	0	0
13.6	0	0	0	0
13.8	0	0	0	0
14.0	0	0	0	0
14.3	0	0	0	0
14.6	0	0	0	0
15.0	0	0	0	0
15.5	0	0	0	0
16.0	0	0	0	0
16.5	0	0	0	0
17.0	0	0	0	0
17.5	0	0	0	0
18.0	0	0	0	0
19.0	0	0	0	0
20.0	0	0	0	0
22.0	0	0	0	0
26.0	0	0	0	0

# RUNOFF CURVE NUMBER COMPUTATION

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 6

Subarea : 6

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	2.1(85)

Total Area (by Hydrologic Soil Group)

2.1

====

SUBAREA: 6

TOTAL DRAINAGE AREA: 2.1 Acres

WEIGHTED CURVE NUMBER: 85



## TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Subtitle: Sub-area 6

```

----- Subarea #1 - 6 -----
Flow Type    2 year    Length    Slope    Surface    n    Area    Wp    Velocity    Time
              rain      (ft)      (ft/ft)   code      (sq/ft) (ft)    (ft/sec)  (hr)
-----
Sheet         1.2        100       0.33     a
Open Channel          470
Open Channel          350
                                     Time of Concentration = 0.08*
                                     =====

Open Channel          470
Open Channel          350
                                     Travel Time = 0.07*
                                     =====

```

## --- Sheet Flow Surface Codes ---

```

A Smooth Surface      F Grass, Dense
B Fallow (No Res.)    G Grass, Burmuda
C Cultivated < 20 % Res. H Woods, Light
D Cultivated > 20 % Res. I Woods, Dense
E Grass-Range, Short  J Range, Natural

```

```

--- Shallow Concentrated ---
--- Surface Codes ---
P Paved
U Unpaved

```

\* - Generated for use by TABULAR method

TABULAR HYDROGRAPH METHOD

Version 2.10

Project : San Juan Co LF Renewal

User: RBB

Date: 05-12-2005

County : San Juan County  
Subtitle: Sub-area 6

State: UT

Checked: \_\_\_\_\_

Date: \_\_\_\_\_

Total watershed area: 0.003 sq mi Rainfall type: II Frequency: 25 years

----- Subareas -----

6  
Area(sq mi) 0.00\*  
Rainfall(in) 2.4  
Curve number 85\*  
Runoff(in) 1.10  
Tc (hrs) 0.08\*  
(Used) 0.10  
TimeToOutlet 0.00  
Ia/P 0.15

Time Total ----- Subarea Contribution to Total Flow (cfs) -----  
(hr) Flow 6

11.0	0	0
11.3	0	0
11.6	0	0
11.9	1	1
12.0	2	2
12.1	4P	4P
12.2	2	2
12.3	1	1
12.4	1	1
12.5	0	0
12.6	0	0
12.7	0	0
12.8	0	0
13.0	0	0
13.2	0	0
13.4	0	0
13.6	0	0
13.8	0	0
14.0	0	0
14.3	0	0
14.6	0	0
15.0	0	0
15.5	0	0
16.0	0	0
16.5	0	0
17.0	0	0
17.5	0	0
18.0	0	0
19.0	0	0
20.0	0	0
21.0	0	0
22.0	0	0
26.0	0	0

P - Peak Flow

\* - value(s) provided from TR-55 system routines

## TR-55 CURVE NUMBER COMPUTATION

VERSION 1.11

Project : SAN JUAN COUNTY LANDFILL      User: RBB      Date: 05-06-99  
County : SAN JUAN COUNTY      State: UT      Checked: \_\_\_\_\_      Date: \_\_\_\_\_  
Subtitle: SUB-AREA 7 OFF-SITE  
Subarea : 7

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Acres (CN)			
-----				
ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	5.05(85)

Total Area (by Hydrologic Soil Group)      5.05  
=====

-----  
SUBAREA: 7      TOTAL DRAINAGE AREA: 5.05 Acres      WEIGHTED CURVE NUMBER:85  
-----

Project : SAN JUAN COUNTY LANDFILL      User: RBB      Date: 05-06-99  
 County : SAN JUAN COUNTY      State: UT      Checked: \_\_\_\_\_      Date: \_\_\_\_\_  
 Subtitle: SUB-AREA 7 OFF-SITE

----- Subarea #1 - 7 -----  

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.2	300	.088	a					0.044
Shallow Concent'd		570	.106	U					0.030

Time of Concentration = 0.07\*

=====

Shallow Concent'd      570      .106      U      0.030

Travel Time = 0.03\*

=====

--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Burmuda	--- Surface Codes ---
C Cultivated = 20 % Res.	H Woods, Light	P Paved
D Cultivated ≠ 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short		

\* - Generated for use by TABULAR method

Project : SAN JUAN COUNTY LANDFILL      User: RBB      Date: 05-06-99  
 County : SAN JUAN COUNTY      State: UT      Checked: \_\_\_\_      Date: \_\_\_\_  
 Subtitle: SUB-AREA 7 OFF-SITE

Total watershed area: 0.008 sq mi    Rainfall type: II    Frequency: 25 years

----- Subareas -----  
 7  
 Area(sq mi)    0.01\*  
 Rainfall(in)    2.4  
 Curve number    85\*  
 Runoff(in)      1.10  
 Tc (hrs)        0.07\*  
                  (Used)    0.10  
 TimeToOutlet    0.00  
 Ia/P            0.15

Time Total ----- Subarea Contribution to Total Flow (cfs) -----  
 (hr) Flow      7

11.0	0	0
11.3	0	0
11.6	0	0
11.9	3	3
12.0	5	5
12.1	9P	9P
12.2	5	5
12.3	2	2
12.4	1	1
12.5	1	1
12.6	1	1
12.7	1	1
12.8	1	1
13.0	1	1
13.2	1	1
13.4	0	0
13.6	0	0
13.8	0	0
14.0	0	0
14.3	0	0
14.6	0	0
15.0	0	0
15.5	0	0
16.0	0	0
16.5	0	0
17.0	0	0
17.5	0	0
18.0	0	0
19.0	0	0
20.0	0	0
22.0	0	0
26.0	0	0

P - Peak Flow      \* - value(s) provided from TR-55 system routines

## TR-55 CURVE NUMBER COMPUTATION

VERSION 1.11

Project : SAN JUAN COUNTY LANDFILL      User: RBB      Date: 05-06-99  
County : SAN JUAN COUNTY      State: UT      Checked: \_\_\_\_\_      Date: \_\_\_\_\_  
Subtitle: SUB-AREA 8 OFF-SITE  
Subarea : 8

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D

ARID AND SEMIARID RANGELANDS				
Sagebrush (w/ grass understory) poor	-	-	-	1.8(85)

Total Area (by Hydrologic Soil Group)      1.8  
=====

-----  
SUBAREA: 8      TOTAL DRAINAGE AREA: 1.8 Acres      WEIGHTED CURVE NUMBER:85  
-----

Project : SAN JUAN COUNTY LANDFILL                  User: RBB                  Date: 05-06-99  
County : SAN JUAN COUNTY              State: UT              Checked: \_\_\_\_\_              Date: \_\_\_\_\_  
Subtitle: SUB-AREA 8 OFF-SITE

----- Subarea #1 - 8 -----									
Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.2	300	.082	a					0.045
Shallow Concent'd		500	.133	U					0.024

Time of Concentration = 0.07\*

— 4 —

Shallow Concent'd	500	.133	U	0.024
-------------------	-----	------	---	-------

Travel Time = 0.02\*

=====

--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Bermuda	--- Surface Codes ---
C Cultivated = 20 % Res.	H Woods, Light	P Paved
D Cultivated ≠ 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short		

\* - Generated for use by TABULAR method

Project : SAN JUAN COUNTY LANDFILL      User: RBB      Date: 05-06-99  
 County : SAN JUAN COUNTY      State: UT      Checked: \_\_\_\_\_      Date: \_\_\_\_\_  
 Subtitle: SUB-AREA 8 OFF-SITE

Total watershed area: 0.003 sq mi    Rainfall type: II    Frequency: 25 years

----- Subareas -----

8  
 Area(sq mi)    0.00\*  
 Rainfall(in)    2.4  
 Curve number    85\*  
 Runoff(in)      1.10  
 Tc (hrs)        0.07\*  
           (Used)    0.10  
 TimeToOutlet    0.00  
 Ia/P            0.15

Time    Total    ----- Subarea Contribution to Total Flow (cfs) -----

(hr)    Flow      8

11.0	0	0
11.3	0	0
11.6	0	0
11.9	1	1
12.0	2	2
12.1	3P	3P
12.2	2	2
12.3	1	1

12.4	0	0
12.5	0	0
12.6	0	0
12.7	0	0
12.8	0	0
13.0	0	0
13.2	0	0
13.4	0	0

13.6	0	0
13.8	0	0
14.0	0	0
14.3	0	0
14.6	0	0
15.0	0	0
15.5	0	0
16.0	0	0

16.5	0	0
17.0	0	0
17.5	0	0
18.0	0	0
19.0	0	0
20.0	0	0
22.0	0	0
26.0	0	0

P - Peak Flow      \* - value(s) provided from TR-55 system routines



## **FlowMaster Results - Final Site Conditions**

(



# Channel D1

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	040000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.34 ft
Flow Area	1.2 ft <sup>2</sup>
Wetted Perim	6.83 ft
Top Width	6.80 ft
Critical Depth	0.35 ft
Critical Slope	0.031991 ft/ft
Velocity	2.60 ft/s
Velocity Head	0.10 ft
Specific Energ	0.44 ft
Froude Numb	1.11
Flow Type	supercritical

# Channel D1 Modified

## Worksheet for Triangular Channel

### Project Description

Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

### Input Data

Mannings Coeffic	0.035
Slope	030000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	3.00 cfs

### Results

Depth	0.36 ft
Flow Area	1.3 ft <sup>2</sup>
Wetted Perim	7.21 ft
Top Width	7.17 ft
Critical Depth	0.35 ft
Critical Slope	0.031992 ft/ft
Velocity	2.33 ft/s
Velocity Head	0.08 ft
Specific Energ	0.44 ft
Froude Numb	0.97
Flow Type	Subcritical

## Channel D2

### Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	040000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.34 ft
Flow Area	1.2 ft <sup>2</sup>
Wetted Perim	6.83 ft
Top Width	6.80 ft
Critical Depth	0.35 ft
Critical Slope	0.031991 ft/ft
Velocity	2.60 ft/s
Velocity Head	0.10 ft
Specific Energ	0.44 ft
Froude Numb	1.11
Flow Type	supercritical

# Channel D2 Modified

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	030000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.36 ft
Flow Area	1.3 ft <sup>2</sup>
Wetted Perim	7.21 ft
Top Width	7.17 ft
Critical Depth	0.35 ft
Critical Slope	0.031992 ft/ft
Velocity	2.33 ft/s
Velocity Head	0.08 ft
Specific Energ	0.44 ft
Froude Numb	0.97
Flow Type	Subcritical

# Channel D3

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	060000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.32 ft
Flow Area	1.0 ft²
Wetted Perim	6.33 ft
Top Width	6.30 ft
Critical Depth	0.35 ft
Critical Slope	0.031991 ft/ft
Velocity	3.02 ft/s
Velocity Head	0.14 ft
Specific Energ	0.46 ft
Froude Numb	1.34
Flow Type	supercritical

# Channel D3 Modified

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	0.00000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.36 ft
Flow Area	1.3 ft <sup>2</sup>
Wetted Perim	7.21 ft
Top Width	7.17 ft
Critical Depth	0.35 ft
Critical Slope	0.031992 ft/ft
Velocity	2.33 ft/s
Velocity Head	0.08 ft
Specific Energ	0.44 ft
Froude Numb	0.97
Flow Type	Subcritical

## Channel D4

### Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	043000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	5.00 cfs

Results	
Depth	0.41 ft
Flow Area	1.6 ft <sup>2</sup>
Wetted Perim	8.16 ft
Top Width	8.12 ft
Critical Depth	0.43 ft
Critical Slope	0.029884 ft/ft
Velocity	3.03 ft/s
Velocity Head	0.14 ft
Specific Energ	0.55 ft
Froude Numb	1.19
Flow Type	supercritical



# Channel D4 Modified

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	030000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	5.00 cfs

Results	
Depth	0.43 ft
Flow Area	1.9 ft <sup>2</sup>
Wetted Perim	8.73 ft
Top Width	8.69 ft
Critical Depth	0.43 ft
Critical Slope	0.029884 ft/ft
Velocity	2.65 ft/s
Velocity Head	0.11 ft
Specific Energy	0.54 ft
Froude Number	1.00
Flow Type	Supercritical

**Channel D5**  
**Worksheet for Triangular Channel**

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	0.43000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	4.00 cfs

Results	
Depth	0.37 ft
Flow Area	1.4 ft <sup>2</sup>
Wetted Perim	7.51 ft
Top Width	7.47 ft
Critical Depth	0.40 ft
Critical Slope	0.030787 ft/ft
Velocity	2.87 ft/s
Velocity Head	0.13 ft
Specific Energ	0.50 ft
Froude Numb	1.17
Flow Type	supercritical

# Channel D5 Modified

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	030000 ft/ft
Left Side Slope	10.00 H : V
Right Side Slope	10.00 H : V
Discharge	4.00 cfs

Results	
Depth	0.40 ft
Flow Area	1.6 ft <sup>2</sup>
Wetted Perim	8.03 ft
Top Width	7.99 ft
Critical Depth	0.40 ft
Critical Slope	0.030787 ft/ft
Velocity	2.50 ft/s
Velocity Head	0.10 ft
Specific Energ	0.50 ft
Froude Numb	0.99
Flow Type	Subcritical

# Channel D6

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	067000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.49 ft
Flow Area	0.7 ft <sup>2</sup>
Wetted Perim	3.10 ft
Top Width	2.94 ft
Critical Depth	0.57 ft
Critical Slope	0.029036 ft/ft
Velocity	4.16 ft/s
Velocity Head	0.27 ft
Specific Energy	0.76 ft
Froude Number	1.48
Flow Type	supercritical

**Channel D7**  
**Worksheet for Triangular Channel**

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	0.24000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	9.00 cfs

Results	
Depth	0.90 ft
Flow Area	2.4 ft <sup>2</sup>
Wetted Perim	5.68 ft
Top Width	5.39 ft
Critical Depth	0.89 ft
Critical Slope	0.025079 ft/ft
Velocity	3.72 ft/s
Velocity Head	0.22 ft
Specific Energ	1.11 ft
Froude Numb	0.98
Flow Type	Subcritical

# Channel D8

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	050000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	9.00 cfs

Results	
Depth	0.78 ft
Flow Area	1.8 ft <sup>2</sup>
Wetted Perim	4.95 ft
Top Width	4.69 ft
Critical Depth	0.89 ft
Critical Slope	0.025079 ft/ft
Velocity	4.90 ft/s
Velocity Head	0.37 ft
Specific Energ	1.16 ft
Froude Numb	1.38
Flow Type	supercritical

**Channel D9**  
**Worksheet for Triangular Channel**

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	067000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	4.00 cfs

Results	
Depth	0.55 ft
Flow Area	0.9 ft <sup>2</sup>
Wetted Perim	3.46 ft
Top Width	3.28 ft
Critical Depth	0.64 ft
Critical Slope	0.027943 ft/ft
Velocity	4.47 ft/s
Velocity Head	0.31 ft
Specific Energy	0.86 ft
Froude Number	1.51
Flow Type	supercritical

**Channel D10**  
**Worksheet for Triangular Channel**

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	0.30000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	4.00 cfs

Results	
Depth	0.64 ft
Flow Area	1.2 ft <sup>2</sup>
Wetted Perim	4.02 ft
Top Width	3.81 ft
Critical Depth	0.64 ft
Critical Slope	0.027943 ft/ft
Velocity	3.30 ft/s
Velocity Head	0.17 ft
Specific Energy	0.80 ft
Froude Number	1.03
Flow Type	supercritical



# Channel D11

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	0.24000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.59 ft
Flow Area	1.1 ft <sup>2</sup>
Wetted Perim	3.76 ft
Top Width	3.57 ft
Critical Depth	0.57 ft
Critical Slope	0.029036 ft/ft
Velocity	2.83 ft/s
Velocity Head	0.12 ft
Specific Energ	0.72 ft
Froude Numb	0.91
Flow Type	Subcritical

# Channel D12

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	050000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.52 ft
Flow Area	0.8 ft²
Wetted Perim	3.28 ft
Top Width	3.11 ft
Critical Depth	0.57 ft
Critical Slope	0.029036 ft/ft
Velocity	3.72 ft/s
Velocity Head	0.22 ft
Specific Energ	0.73 ft
Froude Numb	1.29
Flow Type	supercritical

# Channel D13

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	040000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.54 ft
Flow Area	0.9 ft <sup>2</sup>
Wetted Perim	3.42 ft
Top Width	3.24 ft
Critical Depth	0.57 ft
Critical Slope	0.029035 ft/ft
Velocity	3.43 ft/s
Velocity Head	0.18 ft
Specific Energ	0.72 ft
Froude Numb	1.16
Flow Type	supercritical

## Channel D14

### Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	060000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	4.00 cfs

Results	
Depth	0.56 ft
Flow Area	0.9 ft <sup>2</sup>
Wetted Perim	3.53 ft
Top Width	3.35 ft
Critical Depth	0.64 ft
Critical Slope	0.027943 ft/ft
Velocity	4.29 ft/s
Velocity Head	0.29 ft
Specific Energ	0.84 ft
Froude Numb	1.43
Flow Type	supercritical

# Channel D15

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	040000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	4.00 cfs

Results	
Depth	0.60 ft
Flow Area	1.1 ft <sup>2</sup>
Wetted Perim	3.81 ft
Top Width	3.61 ft
Critical Depth	0.64 ft
Critical Slope	0.027943 ft/ft
Velocity	3.68 ft/s
Velocity Head	0.21 ft
Specific Energy	0.81 ft
Froude Number	1.18
Flow Type	supercritical

# Channel D16

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	020000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	4.00 cfs

Results	
Depth	0.69 ft
Flow Area	1.4 ft <sup>2</sup>
Wetted Perim	4.33 ft
Top Width	4.11 ft
Critical Depth	0.64 ft
Critical Slope	0.027943 ft/ft
Velocity	2.84 ft/s
Velocity Head	0.13 ft
Specific Energ	0.81 ft
Froude Numb	0.85
Flow Type	Subcritical

**Channel D17**  
**Worksheet for Triangular Channel**

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	020000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	1.00 cfs

Results	
Depth	0.41 ft
Flow Area	0.5 ft²
Wetted Perim	2.58 ft
Top Width	2.45 ft
Critical Depth	0.37 ft
Critical Slope	0.033616 ft/ft
Velocity	2.01 ft/s
Velocity Head	0.06 ft
Specific Energ	0.47 ft
Froude Numb	0.78
Flow Type	Subcritical

# Channel D18

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	013000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	1.00 cfs

Results	
Depth	0.44 ft
Flow Area	0.6 ft <sup>2</sup>
Wetted Perim	2.79 ft
Top Width	2.65 ft
Critical Depth	0.37 ft
Critical Slope	0.033616 ft/ft
Velocity	1.71 ft/s
Velocity Head	0.05 ft
Specific Energ	0.49 ft
Froude Numb	0.64
Flow Type	Subcritical



# Channel D19

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	013000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	4.00 cfs

Results	
Depth	0.74 ft
Flow Area	1.7 ft <sup>2</sup>
Wetted Perim	4.70 ft
Top Width	4.46 ft
Critical Depth	0.64 ft
Critical Slope	0.027943 ft/ft
Velocity	2.42 ft/s
Velocity Head	0.09 ft
Specific Energ	0.83 ft
Froude Numb	0.70
Flow Type	Subcritical

**Channel D20**  
**Worksheet for Triangular Channel**

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	080000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	3.00 cfs

Results	
Depth	0.47 ft
Flow Area	0.7 ft <sup>2</sup>
Wetted Perim	3.00 ft
Top Width	2.85 ft
Critical Depth	0.57 ft
Critical Slope	0.029036 ft/ft
Velocity	4.44 ft/s
Velocity Head	0.31 ft
Specific Energ	0.78 ft
Froude Numb	1.61
Flow Type	supercritical

# Channel D21

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	010000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	7.00 cfs

Results	
Depth	0.96 ft
Flow Area	2.8 ft <sup>2</sup>
Wetted Perim	6.09 ft
Top Width	5.78 ft
Critical Depth	0.81 ft
Critical Slope	0.025934 ft/ft
Velocity	2.52 ft/s
Velocity Head	0.10 ft
Specific Energ	1.06 ft
Froude Numb	0.64
Flow Type	Subcritical

# Channel D22

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	010000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	9.00 cfs

Results	
Depth	1.06 ft
Flow Area	3.4 ft <sup>2</sup>
Wetted Perim	6.69 ft
Top Width	6.35 ft
Critical Depth	0.89 ft
Critical Slope	0.025079 ft/ft
Velocity	2.68 ft/s
Velocity Head	0.11 ft
Specific Energ	1.17 ft
Froude Numb	0.65
Flow Type	Subcritical

## Channel D23

### Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	020000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	10.00 cfs

Results	
Depth	0.97 ft
Flow Area	2.8 ft <sup>2</sup>
Wetted Perim	6.11 ft
Top Width	5.80 ft
Critical Depth	0.93 ft
Critical Slope	0.024729 ft/ft
Velocity	3.57 ft/s
Velocity Head	0.20 ft
Specific Energy	1.16 ft
Froude Number	0.91
Flow Type	Subcritical

## Channel D24

### Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	016000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	5.00 cfs

Results	
Depth	0.78 ft
Flow Area	1.8 ft <sup>2</sup>
Wetted Perim	4.91 ft
Top Width	4.66 ft
Critical Depth	0.70 ft
Critical Slope	0.027124 ft/ft
Velocity	2.76 ft/s
Velocity Head	0.12 ft
Specific Energ	0.90 ft
Froude Numb	0.78
Flow Type	Subcritical

# Channel D25

## Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.035
Slope	016000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	1.00 cfs

Results	
Depth	0.42 ft
Flow Area	0.5 ft <sup>2</sup>
Wetted Perim	2.69 ft
Top Width	2.55 ft
Critical Depth	0.37 ft
Critical Slope	0.033616 ft/ft
Velocity	1.85 ft/s
Velocity Head	0.05 ft
Specific Energy	0.48 ft
Froude Numb	0.71
Flow Type	Subcritical

## Channel D26

### Worksheet for Triangular Channel

Project Description	
Worksheet	San Juan County Landfill V-I
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.035
Slope	080000 ft/ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Discharge	4.00 cfs

Results	
Depth	0.53 ft
Flow Area	0.8 ft <sup>2</sup>
Wetted Perim	3.34 ft
Top Width	3.17 ft
Critical Depth	0.64 ft
Critical Slope	0.027943 ft/ft
Velocity	4.77 ft/s
Velocity Head	0.35 ft
Specific Energ	0.88 ft
Froude Numb	1.64
Flow Type	supercritical



**Culvert C1/1**  
**Worksheet for Circular Channel**

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.024
Slope	030000 ft/ft
Diameter	18 in
Discharge	4.00 cfs

Results	
Depth	0.67 ft
Flow Area	0.8 ft²
Wetted Perime	2.19 ft
Top Width	1.49 ft
Critical Depth	0.77 ft
Percent Full	44.3 %
Critical Slope	0.018448 ft/ft
Velocity	5.29 ft/s
Velocity Head	0.43 ft
Specific Energy	1.10 ft
Froude Numbe	1.31
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.004943 ft/ft
Flow Type	supercritical

# Culvert C1/2

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.024
Slope	0.30000 ft/ft
Diameter	18 in
Discharge	7.00 cfs

Results	
Depth	0.93 ft
Flow Area	1.2 ft²
Wetted Perime	2.73 ft
Top Width	1.45 ft
Critical Depth	1.02 ft
Percent Full	62.3 %
Critical Slope	0.023059 ft/ft
Velocity	6.05 ft/s
Velocity Head	0.57 ft
Specific Energ	1.50 ft
Froude Numbe	1.20
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.015137 ft/ft
Flow Type	Supercritical

# Culvert C2/1

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.024
Slope	030000 ft/ft
Diameter	18 in
Discharge	3.00 cfs

Results	
Depth	0.57 ft
Flow Area	0.6 ft <sup>2</sup>
Wetted Perime	1.99 ft
Top Width	1.46 ft
Critical Depth	0.66 ft
Percent Full	37.9 %
Critical Slope	0.017482 ft/ft
Velocity	4.89 ft/s
Velocity Head	0.37 ft
Specific Energ	0.94 ft
Froude Numbe	1.33
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.002780 ft/ft
Flow Type	supercritical

**Culvert C2/1T**  
**Worksheet for Circular Channel**

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.024
Slope	0.13000 ft/ft
Diameter	18 in
Discharge	3.00 cfs

Results	
Depth	0.72 ft
Flow Area	0.8 ft <sup>2</sup>
Wetted Perime	2.29 ft
Top Width	1.50 ft
Critical Depth	0.66 ft
Percent Full	47.8 %
Critical Slope	0.017482 ft/ft
Velocity	3.60 ft/s
Velocity Head	0.20 ft
Specific Energ	0.92 ft
Froude Numbe	0.85
Maximum Disc	6.98 cfs
Discharge Full	6.49 cfs
Slope Full	0.002780 ft/ft
Flow Type	Subcritical

# Culvert C2/2

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.024
Slope	0.30000 ft/ft
Diameter	18 in
Discharge	3.00 cfs

Results	
Depth	0.57 ft
Flow Area	0.6 ft <sup>2</sup>
Wetted Perime	1.99 ft
Top Width	1.46 ft
Critical Depth	0.66 ft
Percent Full	37.9 %
Critical Slope	0.017482 ft/ft
Velocity	4.89 ft/s
Velocity Head	0.37 ft
Specific Energy	0.94 ft
Froude Numbe	1.33
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.002780 ft/ft
Flow Type	supercritical

# Culvert C2/2T

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.024
Slope	013000 ft/ft
Diameter	24 in
Discharge	7.00 cfs

Results	
Depth	1.00 ft
Flow Area	1.6 ft <sup>2</sup>
Wetted Perime	3.14 ft
Top Width	2.00 ft
Critical Depth	0.94 ft
Percent Full	50.1 %
Critical Slope	0.016216 ft/ft
Velocity	4.45 ft/s
Velocity Head	0.31 ft
Specific Energ	1.31 ft
Froude Numbe	0.88
Maximum Disc	15.03 cfs
Discharge Full	13.97 cfs
Slope Full	0.003264 ft/ft
Flow Type	Subcritical

**Culvert C2/3**  
**Worksheet for Circular Channel**

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.024
Slope	030000 ft/ft
Diameter	18 in
Discharge	7.00 cfs

Results	
Depth	0.93 ft
Flow Area	1.2 ft <sup>2</sup>
Wetted Perime	2.73 ft
Top Width	1.45 ft
Critical Depth	1.02 ft
Percent Full	62.3 %
Critical Slope	0.023059 ft/ft
Velocity	6.05 ft/s
Velocity Head	0.57 ft
Specific Energy	1.50 ft
Froude Numbe	1.20
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.015137 ft/ft
Flow Type	supercritical

**Culvert C3/1**  
**Worksheet for Circular Channel**

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.024
Slope	030000 ft/ft
Diameter	18 in
Discharge	3.00 cfs

Results	
Depth	0.57 ft
Flow Area	0.6 ft²
Wetted Perime	1.99 ft
Top Width	1.46 ft
Critical Depth	0.66 ft
Percent Full	37.9 %
Critical Slope	0.017482 ft/ft
Velocity	4.89 ft/s
Velocity Head	0.37 ft
Specific Energ	0.94 ft
Froude Numbe	1.33
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.002780 ft/ft
Flow Type	supercritical



# Culvert C3/1T

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.024
Slope	010000 ft/ft
Diameter	24 in
Discharge	9.00 cfs

Results	
Depth	1.27 ft
Flow Area	2.1 ft²
Wetted Perime	3.70 ft
Top Width	1.92 ft
Critical Depth	1.07 ft
Percent Full	63.7 %
Critical Slope	0.017167 ft/ft
Velocity	4.26 ft/s
Velocity Head	0.28 ft
Specific Energ	1.56 ft
Froude Numbe	0.72
Maximum Disc	13.18 cfs
Discharge Full	12.25 cfs
Slope Full	0.005395 ft/ft
Flow Type	Subcritical

# Culvert C3,4

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.024
Slope	030000 ft/ft
Diameter	24 in
Discharge	19.00 cfs

Results	
Depth	1.48 ft
Flow Area	2.5 ft <sup>2</sup>
Wetted Perime	4.14 ft
Top Width	1.76 ft
Critical Depth	1.57 ft
Percent Full	73.8 %
Critical Slope	0.026210 ft/ft
Velocity	7.64 ft/s
Velocity Head	0.91 ft
Specific Energy	2.38 ft
Froude Number	1.13
Maximum Disc	22.83 cfs
Discharge Full	21.22 cfs
Slope Full	0.024044 ft/ft
Flow Type	supercritical

# Culvert C4/1

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.024
Slope	030000 ft/ft
Diameter	18 in
Discharge	5.00 cfs

Results	
Depth	0.76 ft
Flow Area	0.9 ft²
Wetted Perime	2.37 ft
Top Width	1.50 ft
Critical Depth	0.86 ft
Percent Full	50.4 %
Critical Slope	0.019696 ft/ft
Velocity	5.60 ft/s
Velocity Head	0.49 ft
Specific Energy	1.24 ft
Froude Numbe	1.28
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.007723 ft/ft
Flow Type	supercritical

# Culvert C4/1T

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.024
Slope	020000 ft/ft
Diameter	24 in
Discharge	9.00 cfs

Results	
Depth	1.02 ft
Flow Area	1.6 ft <sup>2</sup>
Wetted Perime	3.19 ft
Top Width	2.00 ft
Critical Depth	1.07 ft
Percent Full	51.1 %
Critical Slope	0.017167 ft/ft
Velocity	5.57 ft/s
Velocity Head	0.48 ft
Specific Energy	1.50 ft
Froude Numbe	1.09
Maximum Disc	18.64 cfs
Discharge Full	17.33 cfs
Slope Full	0.005395 ft/ft
Flow Type	Supercritical

# Culvert C5/1

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.024
Slope	030000 ft/ft
Diameter	18 in
Discharge	4.00 cfs

Results	
Depth	0.67 ft
Flow Area	0.8 ft²
Wetted Perime	2.19 ft
Top Width	1.49 ft
Critical Depth	0.77 ft
Percent Full	44.3 %
Critical Slope	0.018448 ft/ft
Velocity	5.29 ft/s
Velocity Head	0.43 ft
Specific Energ	1.10 ft
Froude Numbe	1.31
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.004943 ft/ft
Flow Type	supercritical

# Culvert C5/1T

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.024
Slope	016000 ft/ft
Diameter	24 in
Discharge	5.00 cfs

Results	
Depth	0.78 ft
Flow Area	1.1 ft <sup>2</sup>
Wetted Perime	2.70 ft
Top Width	1.95 ft
Critical Depth	0.79 ft
Percent Full	39.1 %
Critical Slope	0.015521 ft/ft
Velocity	4.40 ft/s
Velocity Head	0.30 ft
Specific Energy	1.08 ft
Froude Numbe	1.02
Maximum Disc	16.67 cfs
Discharge Full	15.50 cfs
Slope Full	0.001665 ft/ft
Flow Type	Supercritical

# Culvert C5/2

## Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.024
Slope	0.30000 ft/ft
Diameter	18 in
Discharge	5.00 cfs

Results	
Depth	0.76 ft
Flow Area	0.9 ft <sup>2</sup>
Wetted Perime	2.37 ft
Top Width	1.50 ft
Critical Depth	0.86 ft
Percent Full	50.4 %
Critical Slope	0.019696 ft/ft
Velocity	5.60 ft/s
Velocity Head	0.49 ft
Specific Energ	1.24 ft
Froude Numbe	1.28
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.007723 ft/ft
Flow Type	supercritical

## Culvert C6

### Worksheet for Circular Channel

Project Description	
Worksheet	San Juan Co LF Cu
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	030000 ft/ft
Diameter	18 in
Discharge	4.00 cfs

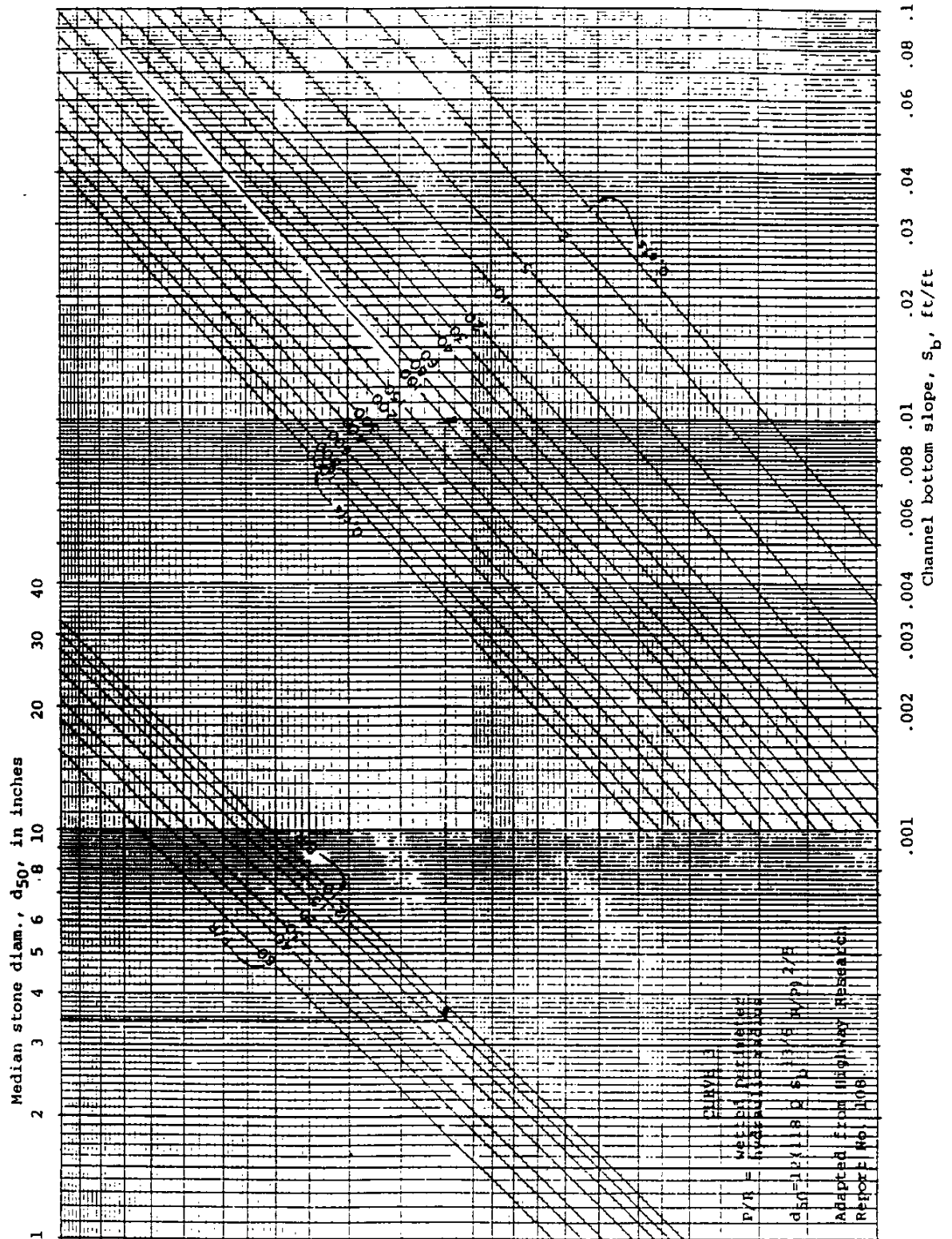
Results	
Depth	0.67 ft
Flow Area	0.8 ft <sup>2</sup>
Wetted Perime	2.19 ft
Top Width	1.49 ft
Critical Depth	0.77 ft
Percent Full	44.3 %
Critical Slope	0.018448 ft/ft
Velocity	5.29 ft/s
Velocity Head	0.43 ft
Specific Energy	1.10 ft
Froude Number	1.31
Maximum Disc	10.60 cfs
Discharge Full	9.85 cfs
Slope Full	0.004943 ft/ft
Flow Type	supercritical



**Rip-Rap Sizing Charts**

**(from USDA, 1975)**

## MEDIAN RIPRAP DIAMETER FOR STRAIGHT TRAPEZOIDAL CHANNELS



## APPENDIX A-39

## DESIGN PROCEDURE FOR RIPRAP-LINED CHANNELS

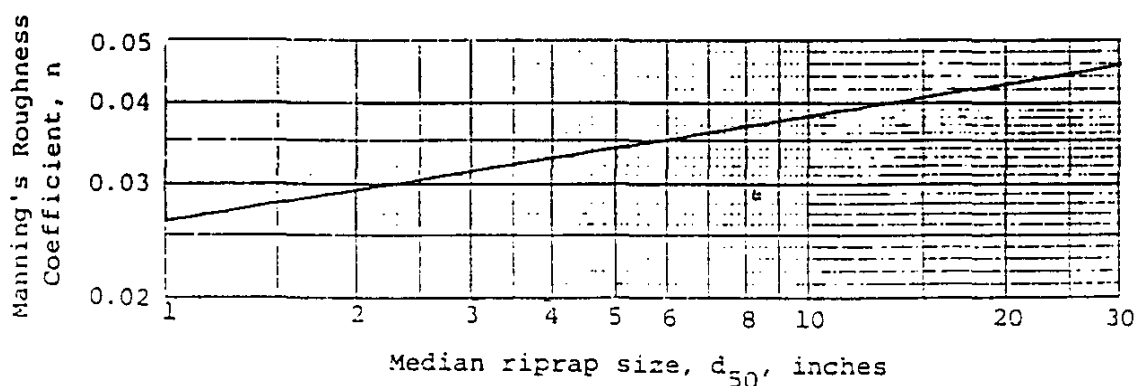
This design of riprap-lined channels is from the National Cooperative Highway Research Program Report No. 108, entitled "Tentative Design Procedure for Riprap-Lined Channels." It is based on the tractive force method and covers the design of riprap in two basic channel shapes, trapezoidal and triangular. (19)

NOTE: This procedure is for the uniform flow in channels and is not to be used for design of riprap deenergizing devices immediately downstream from such high velocity devices as pipes and culverts. See the Standard and Specification for Storm Drain Outlet Protection.

The method in Report No. 108 (design procedure beginning on p. 18) gives a simple and direct solution to the design of trapezoidal channels including channel carrying capacity, channel geometry and the riprap lining. The publication is a very good reference and design aid.

The procedure presented in this Appendix is based on the assumption that the channel is already designed and the remaining problem is to determine the riprap size that would be stable in the channel. The designer would first determine the channel dimensions by the use of Manning's equation. The  $n$  value for use in Manning's equation is estimated by estimating a riprap size and then determining the corresponding  $n$  value for the riprapped channel from Curve 1, below.

Curve 1 - Manning's "n" for Riprap-Lined Channels  
 $n = 0.0395(d_{50})^{1/6}$



## **APPENDIX K**

### **Loading Rate and Frost Penetration Calculations**

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Application for Renewal  
San Juan County Landfill

## 2005 LOADING RATE CALCULATIONS

### San Juan County Landfill

In-Place Waste Density<sup>1</sup>: 1,100 lb/cy

Waste-to-Soil Ratio: 3 : 1

Target Volume: 1,946,800 cy

Year	Years of Operation	Predicted Population Growth Rate	WASTE DISPOSAL			SOIL REQUIREMENT		TOTAL FILL	
			Annual Total (tons) <sup>5</sup>	Disposal Rate <sup>4</sup> (tons/day)	In-Place Volume (cy)	In-Place Volume (cy)	Cumulative Volume (cy)	Annual Volume (cy)	Cumulative Volume (cy)
2000	0		10,247	28.1	18,631	6,210	6,210	24,841	24,841
2001	0	-2.07%	11,012	30.2	20,022	6,674	12,884	26,696	51,537
2002	0	1.09%	13,043	35.7	23,714	7,905	20,789	31,619	83,156
2003	0	0.17%	13,937	38.2	25,340	8,447	29,236	33,787	116,943
2004	0	0.79%	11,046	30.3	20,083	6,694	35,930	26,778	143,721
<b>INITIAL TOTAL</b>									<b>143,721</b>
2005	1	0.63%	12,337	33.8	22,431	7,477	43,407	29,908	173,629
2006	2	-0.01%	12,336	33.8	22,430	7,477	50,884	29,906	203,535
2007	3	-0.19%	12,312	33.7	22,386	7,462	58,346	29,848	233,384
2008	4	0.04%	12,318	33.7	22,396	7,465	65,811	29,861	263,244
2009	5	0.51%	12,381	33.9	22,510	7,503	73,315	30,014	293,258
<b>5-YEAR TOTAL</b>									<b>149,537</b>
2010	6	0.56%	12,450	34.1	22,636	7,545	80,860	30,181	323,439
2011	7	0.64%	12,529	34.3	22,780	7,593	88,453	30,373	353,812
2012	8	0.75%	12,622	34.6	22,949	7,650	96,103	30,599	384,411
2013	9	0.85%	12,730	34.9	23,145	7,715	103,818	30,860	415,272
2014	10	0.93%	12,849	35.2	23,361	7,787	111,605	31,148	446,420
2015	11	1.00%	12,977	35.6	23,595	7,865	119,470	31,460	477,880
2016	12	1.02%	13,110	35.9	23,837	7,946	127,416	31,783	509,663
2017	13	1.01%	13,243	36.3	24,077	8,026	135,441	32,103	541,766
2018	14	0.97%	13,371	36.6	24,311	8,104	143,545	32,415	574,181
2019	15	0.99%	13,503	37.0	24,552	8,184	151,729	32,736	606,917
<b>10-YEAR TOTAL</b>									<b>313,659</b>
2020	16	0.95%	13,631	37.3	24,784	8,261	159,991	33,046	639,962
2021	17	0.93%	13,758	37.7	25,014	8,338	168,329	33,352	673,314
2022	18	0.89%	13,880	38.0	25,237	8,412	176,741	33,650	706,964
2023	19	0.85%	13,999	38.4	25,453	8,484	185,225	33,937	740,901
2024	20	0.83%	14,115	38.7	25,664	8,555	193,780	34,219	775,120
2025	21	0.83%	14,232	39.0	25,877	8,626	202,406	34,503	809,622
2026	22	0.81%	14,348	39.3	26,087	8,696	211,101	34,782	844,405
2027	23	0.81%	14,464	39.6	26,298	8,766	219,867	35,064	879,468
2028	24	0.79%	14,578	39.9	26,506	8,835	228,702	35,341	914,809
2029	25	0.79%	14,693	40.3	26,714	8,905	237,607	35,619	950,428
<b>10-YEAR TOTAL</b>									<b>343,611</b>
2030	26	0.78%	14,807	40.6	26,922	8,974	246,581	35,896	986,324
2031	27	0.77%	14,922	40.9	27,130	9,043	255,624	36,174	1,022,497
2032	28	0.76%	15,035	41.2	27,337	9,112	264,737	36,449	1,058,946
2033	29	0.76%	15,149	41.5	27,543	9,181	273,918	36,724	1,095,671
2034	30	0.75%	15,262	41.8	27,750	9,250	283,168	37,000	1,132,671
2035	31	0.74%	15,376	42.1	27,957	9,319	292,487	37,275	1,169,946
2036	32	0.74%	15,490	42.4	28,163	9,388	301,874	37,551	1,207,497
2037	33	0.74%	15,604	42.8	28,371	9,457	311,331	37,828	1,245,325
2038	34	0.73%	15,718	43.1	28,578	9,526	320,857	38,104	1,283,429
2039	35	0.72%	15,831	43.4	28,784	9,595	330,452	38,379	1,321,808
<b>10-YEAR TOTAL</b>									<b>371,380</b>

cont.

## 2005 LOADING RATE CALCULATIONS (cont.)

### San Juan County Landfill

Year	Years of Operation	Predicted Population Growth Rate	WASTE DISPOSAL			SOIL REQUIREMENT		TOTAL FILL	
			Annual Total (tons) <sup>5</sup>	Disposal Rate <sup>4</sup> (tons/day)	In-Place Volume (cy)	In-Place Volume (cy)	Cumulative Volume (cy)	Annual Volume (cy)	Cumulative Volume (cy)
2040	36	0.72%	15,945	43.7	28,991	9,664	340,116	38,655	1,360,463
2041	37	0.71%	16,059	44.0	29,198	9,733	349,848	38,930	1,399,393
2042	38	0.71%	16,173	44.3	29,406	9,802	359,650	39,208	1,438,601
2043	39	0.70%	16,287	44.6	29,612	9,871	369,521	39,483	1,478,084
2044	40	0.69%	16,400	44.9	29,817	9,939	379,460	39,756	1,517,840
2045	41	0.69%	16,513	45.2	30,024	10,008	389,468	40,032	1,557,872
2046	42	0.69%	16,628	45.6	30,232	10,077	399,545	40,309	1,598,181
2047	43	0.69%	16,743	45.9	30,441	10,147	409,692	40,589	1,638,770
2048	44	0.69%	16,859	46.2	30,652	10,217	419,910	40,870	1,679,639
2049	45	0.69%	16,976	46.5	30,865	10,288	430,198	41,153	1,720,792
<b>10-YEAR TOTAL</b>								<b>398,984</b>	
2050	46	0.69%	17,093	46.8	31,079	10,360	440,558	41,438	1,762,230
2051	47	0.69%	17,212	47.2	31,294	10,431	450,989	41,725	1,803,956
2052	48	0.69%	17,331	47.5	31,511	10,504	461,492	42,014	1,845,970
2053	49	0.69%	17,451	47.8	31,729	10,576	472,069	42,305	1,888,275
2054	50	0.69%	17,572	48.1	31,949	10,650	482,718	42,598	1,930,873
2055	51	0.69%	17,694	48.5	32,170	10,723	493,442	42,894	1,973,767
<b>6-YEAR TOTAL</b>								<b>252,975</b>	
<b>TARGET VOLUME</b>								<b>1,946,800</b>	
<sup>1</sup> From San Juan County scale records from 2000-2004. <sup>2</sup> From growth rate projected by the Utah Governor's Office of Planning and Budget (via Internet). <sup>3</sup> Figure estimated from the Caterpillar Handbook, Edition 28, 1998, for an 816B landfill compactor. <sup>4</sup> Based on a 365-day average. <sup>5</sup> Predicted tonnage for 2005 based on average of previous 4 years multiplied by population growth factor.									

**Population  
By County and Multi-County District  
2000 - 2050**

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Beaver	8,023	8,198	8,285	8,285	8,308	8,335	8,319	8,575	8,866	7,200	7,575	7,976	8,395
Box Elder	42,880	43,245	43,812	44,022	44,654	45,142	45,358	46,195	47,146	48,170	49,254	50,359	51,520
Cache	91,897	93,372	95,460	98,176	100,182	102,477	104,258	106,607	109,020	111,552	114,304	117,285	120,425
Carbon	20,396	19,858	19,858	19,558	19,385	19,205	18,896	18,834	18,851	18,919	19,023	19,139	19,281
Daggett	933	944	916	921	954	967	979	989	1,000	1,012	1,024	1,036	1,049
Davis	240,204	246,744	255,099	262,038	268,918	276,374	282,217	287,924	293,434	298,981	304,502	310,054	315,534
Duchessne	14,397	14,646	14,856	14,698	14,933	15,043	15,049	15,203	15,399	15,632	15,897	16,172	16,469
Emery	10,782	10,473	10,540	10,477	10,493	10,492	10,423	10,356	10,329	10,327	10,346	10,381	10,435
Garfield	4,763	4,630	4,599	4,532	4,465	4,425	4,403	4,776	4,861	4,955	5,055	5,159	5,263
Grand	8,537	8,423	8,468	8,464	8,611	8,691	8,724	8,795	8,872	8,953	9,039	9,122	9,206
Iron	34,079	35,541	36,122	37,559	38,925	40,212	41,391	43,155	44,959	46,829	48,772	50,741	52,895
Juab	8,310	8,570	8,843	8,713	8,828	8,917	8,959	9,239	9,522	9,812	10,112	10,416	10,723
Kane	8,037	8,037	5,958	5,937	6,056	6,093	6,107	6,208	6,329	6,465	6,616	6,776	6,945
Millard	12,461	12,466	12,760	13,068	13,127	13,305	13,398	13,513	13,691	13,922	14,199	14,492	14,829
Morgan	7,181	7,548	7,639	7,938	8,249	8,525	8,782	9,049	9,378	9,757	10,183	10,623	11,110
Plute	1,436	1,404	1,409	1,358	1,368	1,356	1,335	1,376	1,418	1,460	1,503	1,545	1,586
Rich	1,955	1,983	2,050	2,079	2,069	2,086	2,085	2,093	2,106	2,125	2,147	2,169	2,195
Salt Lake	902,777	918,279	927,564	940,485	955,166	970,748	986,073	1,001,098	1,017,501	1,034,985	1,053,258	1,071,834	1,090,541
San Juan	14,380	14,063	14,216	14,240	14,353	14,444	14,443	14,415	14,421	14,442	14,481	14,522	14,573
Sanpete	22,848	23,572	24,521	24,787	25,043	25,447	25,835	26,173	26,730	27,307	27,904	28,502	29,100
Sewer	18,938	19,180	19,232	19,318	19,415	19,494	19,468	19,809	20,187	20,599	21,038	21,473	21,912
Summit	30,048	31,279	32,236	34,073	35,090	36,417	37,824	39,214	40,890	42,855	44,511	46,431	48,441
Tooele	41,549	44,425	47,019	48,958	50,075	51,835	53,213	56,693	60,136	63,619	67,150	70,690	74,162
Uintah	25,297	26,049	25,984	26,019	26,224	26,317	26,277	26,441	26,630	26,842	27,071	27,303	27,545
Utah	371,894	390,447	405,977	423,296	437,627	453,977	470,178	484,992	499,520	513,708	527,502	541,053	554,481
Wasatch	15,433	16,278	17,476	18,515	19,177	20,139	20,974	22,046	23,155	24,310	25,516	26,745	27,999
Washington	91,104	98,902	103,750	109,767	117,316	125,010	132,356	139,642	147,046	154,882	162,544	170,628	178,926
Wayne	2,515	2,509	2,504	2,487	2,518	2,527	2,522	2,574	2,630	2,694	2,764	2,835	2,909
Weber	197,541	200,567	203,377	205,882	209,547	212,707	214,701	218,135	221,899	225,925	230,145	234,445	238,784
MCD													
Bear River	136,712	138,600	141,322	144,277	148,905	149,705	151,888	154,895	158,272	161,847	165,705	169,813	174,140
Wasatch Front	1,389,252	1,417,563	1,440,698	1,465,279	1,491,953	1,520,189	1,544,986	1,572,899	1,602,348	1,633,267	1,665,238	1,697,646	1,730,131
Mountainland	417,375	438,004	455,689	475,874	491,894	510,532	528,776	546,252	563,965	580,673	597,529	614,229	630,921
Central	72,543	73,758	75,027	75,668	76,351	77,139	77,422	78,892	80,507	82,259	84,138	86,039	88,004
Southwest	135,969	143,271	150,756	158,143	167,174	176,202	184,708	194,075	203,847	213,672	223,846	234,400	245,175
Uintah Basin	40,627	41,839	41,756	41,838	42,111	42,327	42,305	42,833	43,029	43,496	43,992	44,511	45,063
Southeast	54,075	52,817	53,082	52,739	52,842	52,832	52,486	52,400	52,473	52,641	52,889	53,164	53,495
State of Utah	2,246,553	2,305,652	2,358,330	2,413,618	2,469,230	2,528,926	2,582,371	2,642,046	2,703,841	2,767,745	2,833,337	2,899,802	2,966,829
United States	282,124,631	284,796,886	287,448,526	290,115,554	292,800,571	295,507,134	298,217,215	300,912,947	303,597,646	306,272,395	308,935,581	311,600,880	314,281,098

Note: All populations are dated July 1.

Source: 2005 Baseline Projections, Governor's Office of Planning and Budget

**Population  
By County and Multi-County District  
2000 - 2060**

Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Beaver	8,829	9,258	9,682	10,101	10,500	10,866	11,219	11,549	11,848	12,121	12,382	12,622	12,843
Box Elder	52,733	53,972	55,212	56,463	57,735	59,039	60,353	61,675	62,985	64,273	65,538	66,796	68,038
CACHE	123,681	127,007	130,375	133,805	137,244	140,729	144,239	147,776	151,311	154,841	158,391	161,993	165,626
Carbon	19,442	19,824	19,819	20,031	20,254	20,486	20,730	20,982	21,227	21,468	21,705	21,939	22,169
Daggett	1,062	1,075	1,087	1,099	1,110	1,121	1,131	1,141	1,150	1,158	1,166	1,174	1,181
Davis	320,866	325,971	330,833	335,487	339,944	344,262	348,384	352,320	356,047	359,575	362,929	366,144	369,206
Duchesne	16,784	17,105	17,427	17,751	18,074	18,395	18,712	19,021	19,318	19,606	19,883	20,150	20,409
Emery	10,507	10,594	10,696	10,809	10,934	11,068	11,210	11,359	11,502	11,642	11,780	11,913	12,038
Garfield	5,264	5,367	5,469	5,566	5,667	5,770	5,873	5,973	6,069	6,160	6,247	6,333	6,412
Grand	9,288	9,365	9,439	9,508	9,574	9,637	9,696	9,751	9,803	9,850	9,894	9,935	9,974
Iron	54,804	56,439	58,190	59,871	61,435	62,902	64,288	65,607	66,864	68,065	69,238	70,395	71,540
Juab	11,024	11,314	11,593	11,856	12,108	12,350	12,580	12,798	13,005	13,205	13,393	13,577	13,754
Kane	7,121	7,299	7,476	7,652	7,830	8,009	8,185	8,359	8,525	8,684	8,839	8,990	9,135
Millard	15,205	15,605	16,019	16,460	16,922	17,405	17,893	18,386	18,869	19,340	19,799	20,243	20,670
Morgan	11,639	12,190	12,760	13,328	13,960	14,669	15,417	16,200	17,000	17,815	18,641	19,506	20,384
Plute	1,625	1,660	1,692	1,717	1,739	1,758	1,777	1,790	1,801	1,808	1,814	1,817	1,818
Rich	2,225	2,255	2,286	2,316	2,348	2,382	2,414	2,447	2,476	2,504	2,530	2,553	2,574
Salt Lake	1,109,160	1,127,439	1,145,337	1,162,882	1,180,188	1,197,425	1,214,298	1,230,817	1,246,892	1,262,712	1,278,298	1,293,783	1,309,168
San Juan	14,635	14,710	14,792	14,886	14,997	15,125	15,266	15,419	15,577	15,734	15,887	16,044	16,196
Sanpete	29,687	30,247	30,773	31,284	31,723	32,150	32,544	32,902	33,227	33,522	33,790	34,036	34,261
Sevier	22,343	22,757	23,151	23,524	23,882	24,227	24,550	24,855	25,136	25,397	25,639	25,863	26,072
Summit	50,501	52,566	54,618	56,651	58,705	60,796	62,898	65,001	67,094	69,184	71,265	73,359	75,450
Tooele	77,500	80,677	83,661	86,461	89,041	91,441	93,651	95,696	97,615	99,418	101,145	102,822	104,459
Utah	27,787	28,023	28,255	28,477	28,692	28,899	29,099	29,289	29,467	29,633	29,791	29,941	30,083
Utah	567,878	581,228	594,511	607,805	621,099	634,455	647,865	661,319	674,931	688,696	702,614	716,682	730,897
Wasatch	29,249	30,474	31,664	32,811	33,923	35,007	36,060	37,082	38,072	39,038	39,986	40,915	41,837
Washington	187,430	196,133	205,025	214,094	223,330	232,730	242,245	251,896	261,655	271,504	281,426	291,401	301,459
Wayne	2,982	3,056	3,128	3,197	3,267	3,337	3,403	3,469	3,529	3,589	3,644	3,696	3,747
Weber	243,107	247,361	251,528	255,600	259,597	263,574	267,486	271,339	275,100	278,790	282,421	286,021	289,584
MCD													
Bear River	178,639	183,234	187,873	192,584	197,327	202,150	207,006	211,898	216,772	221,618	226,459	231,342	236,238
Wasatch Front	1,782,272	1,793,638	1,824,119	1,853,758	1,882,730	1,911,371	1,939,236	1,966,372	1,992,654	2,018,310	2,043,434	2,068,278	2,092,801
Mountainland	847,628	864,268	880,793	897,267	913,727	930,258	946,823	963,402	979,987	996,581	1,013,185	1,029,799	1,046,424
Central	89,987	91,938	93,832	95,670	97,471	99,236	100,930	102,559	104,092	105,545	106,918	108,222	109,457
Southwest	256,127	267,197	278,366	289,632	300,932	312,256	323,624	335,025	346,436	357,850	369,293	380,751	392,254
Utah Basin	45,633	46,203	46,769	47,327	47,876	48,415	48,942	49,451	49,935	50,397	50,840	51,265	51,673
Southeast	53,872	54,293	54,746	55,234	55,759	56,318	56,902	57,511	58,109	58,694	59,266	59,831	60,377
State of Utah	3,034,158	3,100,771	3,166,498	3,231,472	3,295,822	3,360,002	3,423,463	3,486,218	3,548,095	3,609,332	3,670,075	3,730,643	3,790,984
United States	316,971,485	319,687,598	322,365,787	325,062,633	327,755,597	330,443,861	333,127,039	335,804,546	338,489,500	341,195,095	343,921,378	346,669,052	349,439,199

Note: All populations are dated July 1.

Source: 2005 Baseline Projections, Governor's Office of Planning and Budget



Population  
By County and Multi-County District  
2000 - 2050

Area	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Beaver	13,044	13,233	13,411	13,583	13,761	13,937	14,113	14,289	14,466	14,643	14,820	14,998	15,176
Box Elder	69,250	70,416	71,568	72,699	73,833	74,975	76,119	77,267	78,419	79,576	80,739	81,907	83,082
Cache	169,272	172,898	176,562	180,242	183,969	187,749	191,544	195,371	199,229	203,123	207,053	211,022	215,032
Carbon	22,388	22,594	22,797	22,993	23,186	23,384	23,578	23,772	23,965	24,158	24,350	24,542	24,734
Daegott	1,187	1,193	1,199	1,204	1,209	1,214	1,219	1,224	1,229	1,234	1,239	1,244	1,249
Davis	372,108	374,827	377,416	379,867	382,219	384,528	386,810	389,065	391,291	393,492	395,670	397,825	399,959
Duchesne	20,650	20,875	21,091	21,296	21,497	21,701	21,904	22,106	22,308	22,509	22,710	22,912	23,113
Emery	12,156	12,262	12,360	12,451	12,536	12,624	12,711	12,798	12,884	12,970	13,055	13,141	13,226
Garfield	6,488	6,558	6,625	6,687	6,747	6,809	6,870	6,931	6,992	7,053	7,114	7,174	7,235
Grand	10,008	10,041	10,071	10,100	10,129	10,157	10,185	10,213	10,241	10,268	10,295	10,322	10,349
Iron	72,683	73,830	75,008	76,221	77,493	78,736	79,990	81,253	82,518	83,791	85,070	86,357	87,652
Juab	13,922	14,084	14,241	14,393	14,546	14,699	14,851	15,003	15,155	15,307	15,458	15,610	15,762
Kane	9,275	9,407	9,536	9,660	9,783	9,908	10,032	10,156	10,280	10,405	10,530	10,655	10,781
Millard	21,074	21,445	21,797	22,125	22,439	22,766	23,091	23,415	23,742	24,069	24,397	24,727	25,058
Morgan	21,248	22,083	22,926	23,739	24,595	25,468	26,359	27,271	28,205	29,159	30,137	31,138	32,163
Plute	1,815	1,811	1,807	1,803	1,797	1,809	1,821	1,832	1,844	1,855	1,867	1,878	1,890
Rich	2,591	2,606	2,618	2,627	2,636	2,645	2,654	2,663	2,672	2,681	2,690	2,698	2,707
Salt Lake	1,324,200	1,338,852	1,353,295	1,367,442	1,381,519	1,395,630	1,409,700	1,423,737	1,437,761	1,451,773	1,465,781	1,479,792	1,493,816
San Juan	16,346	16,492	16,633	16,771	16,910	17,047	17,185	17,321	17,457	17,593	17,729	17,864	17,999
Sanpete	34,465	34,653	34,832	35,006	35,181	35,354	35,526	35,698	35,866	36,034	36,202	36,369	36,535
Sevier	26,261	26,434	26,595	26,746	26,892	27,041	27,188	27,334	27,479	27,624	27,768	27,911	28,053
Summit	77,527	79,567	81,604	83,625	85,680	87,732	89,825	91,942	94,086	96,256	98,454	100,682	102,940
Tooele	106,083	107,694	109,327	110,989	112,722	114,421	116,133	117,853	119,576	121,306	123,045	124,791	126,548
Utah	30,211	30,328	30,438	30,541	30,641	30,742	30,842	30,941	31,039	31,136	31,233	31,329	31,424
Wasatch	745,259	759,764	774,409	789,193	804,112	819,239	834,574	850,120	865,876	881,844	898,024	914,419	931,028
Wasatch	42,731	43,607	44,475	45,333	46,193	47,063	47,938	48,818	49,705	50,598	51,498	52,406	53,322
Washington	311,629	321,937	332,407	343,062	353,922	364,917	376,109	387,495	399,073	410,840	422,791	434,922	447,230
Wayne	3,793	3,834	3,873	3,908	3,943	3,978	4,013	4,048	4,083	4,118	4,153	4,187	4,222
Weber	293,057	296,425	299,739	302,987	306,227	309,472	312,710	315,941	319,171	322,399	325,627	328,858	332,092
MCD													
Bear River	241,113	245,920	250,748	255,588	260,458	265,369	270,317	275,301	280,320	285,380	290,482	295,627	300,821
Wasatch Front	2,116,696	2,139,881	2,162,703	2,185,024	2,207,282	2,229,519	2,251,712	2,273,867	2,296,004	2,318,129	2,340,260	2,362,404	2,384,578
Mountainland	885,517	882,938	900,488	918,151	935,965	954,034	972,337	990,880	1,009,667	1,028,698	1,047,978	1,067,507	1,087,290
Central	110,805	111,668	112,681	113,641	114,561	115,555	116,522	117,484	118,449	119,412	120,375	121,337	122,301
Southwest	403,844	415,558	427,451	439,553	451,923	464,399	477,082	489,968	503,049	516,327	529,795	543,451	557,293
Utah Basin	52,048	52,396	52,728	53,041	53,347	53,657	53,965	54,271	54,578	54,879	55,182	55,485	55,786
Southeast	60,898	61,389	61,861	62,315	62,763	63,212	63,659	64,104	64,547	64,989	65,429	65,869	66,308
State of Utah	3,850,721	3,909,750	3,968,660	4,027,293	4,086,319	4,145,745	4,205,594	4,265,875	4,326,612	4,387,814	4,449,499	4,511,680	4,574,377
United States	352,228,788	355,035,364	357,861,695	360,710,638	363,584,435	366,485,653	369,336,185	372,196,416	375,046,474	377,886,238	380,716,084	383,536,870	386,348,260

Note: All populations are dated July 1.


Source: 2005 Baseline Projections, Governor's Office of Planning and Budget

**Population  
By County and Multi-County District  
2000 - 2050**

Area	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Beaver	15,355	15,535	15,715	15,897	16,079	16,262	16,446	16,630	16,816	17,001	17,187	17,373
Box Elder	84,265	85,455	86,654	87,860	89,075	90,297	91,528	92,768	94,016	95,269	96,527	97,789
Cache	219,086	223,185	227,330	231,522	235,761	240,047	244,382	248,765	253,198	257,687	262,172	266,711
Carbon	24,926	25,118	25,310	25,502	25,694	25,886	26,079	26,271	26,464	26,656	26,848	27,039
Daggett	1,254	1,258	1,263	1,268	1,273	1,277	1,282	1,287	1,291	1,296	1,301	1,305
Davis	402,073	404,170	406,249	408,310	410,364	412,382	414,393	416,388	418,367	420,325	422,282	424,177
Duchesne	23,314	23,516	23,717	23,919	24,122	24,324	24,527	24,731	24,934	25,138	25,341	25,543
Emery	13,311	13,396	13,480	13,565	13,650	13,735	13,819	13,904	13,988	14,072	14,156	14,240
Garfield	7,296	7,356	7,417	7,478	7,539	7,600	7,661	7,722	7,783	7,844	7,905	7,966
Grand	10,376	10,403	10,429	10,455	10,482	10,508	10,534	10,559	10,585	10,611	10,636	10,661
Iron	88,955	90,268	91,591	92,924	94,266	95,618	96,981	98,353	99,736	101,125	102,520	103,920
Juab	15,915	16,067	16,220	16,373	16,527	16,681	16,836	16,990	17,146	17,301	17,456	17,611
Kane	10,907	11,033	11,160	11,288	11,416	11,545	11,674	11,804	11,934	12,065	12,196	12,327
Millard	25,391	25,726	26,063	26,402	26,743	27,086	27,430	27,777	28,126	28,476	28,827	29,179
Morgan	33,213	34,290	35,393	36,523	37,682	38,869	40,085	41,330	42,606	43,909	45,239	46,596
Piute	1,901	1,913	1,924	1,936	1,947	1,958	1,970	1,981	1,992	2,004	2,015	2,026
Rich	2,716	2,724	2,733	2,741	2,750	2,758	2,767	2,775	2,784	2,792	2,800	2,809
Salt Lake	1,507,858	1,521,926	1,536,022	1,550,146	1,564,299	1,578,481	1,592,695	1,606,942	1,621,221	1,635,491	1,649,749	1,663,994
San Juan	18,134	18,269	18,404	18,540	18,675	18,810	18,945	19,080	19,218	19,351	19,485	19,620
Sanpete	36,701	36,866	37,031	37,195	37,359	37,522	37,685	37,848	38,010	38,172	38,332	38,492
Sevier	28,196	28,337	28,479	28,620	28,761	28,902	29,042	29,182	29,322	29,461	29,600	29,738
Summit	105,230	107,554	109,912	112,304	114,731	117,193	119,690	122,224	124,795	127,395	130,023	132,681
Tooele	128,314	130,092	131,881	133,682	135,495	137,319	139,156	141,004	142,865	144,732	146,606	148,488
Utah	31,519	31,614	31,708	31,802	31,895	31,988	32,081	32,173	32,265	32,357	32,448	32,538
Wasatch	947,852	964,893	982,151	999,626	1,017,320	1,035,232	1,053,364	1,071,716	1,090,289	1,109,082	1,128,097	1,147,333
Washington	54,246	55,179	56,122	57,073	58,034	59,004	59,984	60,974	61,973	62,978	63,991	65,010
Wayne	459,710	472,355	485,163	498,125	511,238	524,493	537,885	551,406	565,049	578,818	593,013	607,334
Weber	4,257	4,292	4,326	4,361	4,396	4,431	4,466	4,501	4,535	4,570	4,605	4,640
	335,332	338,579	341,833	345,095	348,365	351,643	354,929	358,224	361,527	364,830	368,130	371,429
MCD												
Bear River	306,067	311,364	316,717	322,123	327,586	333,102	338,677	344,308	349,998	355,728	361,499	367,309
Wasatch Front	2,406,790	2,429,057	2,451,378	2,473,756	2,496,195	2,518,694	2,541,258	2,563,888	2,586,586	2,609,287	2,631,986	2,654,682
Mountainland	1,107,328	1,127,826	1,148,185	1,169,003	1,190,085	1,211,429	1,233,038	1,254,914	1,277,057	1,299,455	1,322,111	1,345,024
Central	123,268	124,234	125,203	126,175	127,149	128,125	129,103	130,083	131,065	132,049	133,031	134,013
Southwest	571,316	585,514	599,886	614,424	629,122	643,973	658,973	674,111	689,384	704,888	720,625	736,593
Utah Basin	56,087	56,388	56,688	56,989	57,290	57,589	57,890	58,191	58,490	58,791	59,090	59,386
Southeast	66,747	67,186	67,623	68,062	68,501	68,939	69,377	69,814	70,253	70,690	71,125	71,560
State of Utah	4,637,603	4,701,369	4,765,680	4,830,532	4,895,928	4,961,851	5,028,316	5,095,309	5,162,833	5,230,888	5,299,467	5,368,567
United States	389,151,161	391,945,658	394,734,076	397,518,901	400,300,776	403,081,225	405,862,392	408,646,486	411,434,861	414,229,883	417,034,861	419,853,587

Note: All populations are dated July 1.

Source: 2005 Baseline Projections, Governor's Office of Planning and Budget



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# Governor's Office of Planning & Budget

State Capitol Complex, Suite E210, Salt Lake City, Utah 84114-2210  
 Telephone: 801 538-1027 - Fax: 801 538-1547

## Demographic and Economic Analysis

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## DEA - Long-Term Projections

### 2005 Baseline Economic and Demographic Projections

Demographic and Economic Tables			
Table Description PDF Format	Contents - Notes	CSV Format	Excel Format
<a href="#">Population by Area</a>	Population, Births, Deaths, Net Migration	<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">Total Employment by Area</a>		<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">Employment by NAICS Sector and Area</a>		<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">Households by Area</a>	Households, Household Population, Total Population, Group Quarters Population, Household Size	<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">5 Year Age Group by Area and Gender</a>		<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">Age Group by Area and Gender</a>		<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">Dependency Ratios by Area</a>		<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">Hachman Index by Area</a>		<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">Location Quotient by Area and NAICS Category</a>		<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">Median Age by Area and Gender</a>		<a href="#">csv</a>	<a href="#">Excel</a>
<a href="#">Population by Area and Single Year of Age</a>		<a href="#">csv</a>	<a href="#">Excel</a>

[Demographics](#) | [Economics](#) | [State Short-Run Forecasts](#) | [Long-Term Projections](#) |

**San Juan County Landfill**  
**Frost Penetration Depth Calculations**

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Total Degree Days:	6,599
Mean Annual Temperature (MAT):	50 degrees F
Air Freezing Index (F):	219 based on 32 F
Length of Freezing Season (t):	66 days (avg temp > 32F)
Air Thawing Index (I):	6818 based on 32 F
Length of Thawing Season (t):	299 days
Conversion factor for soil (n):	0.7 (Tbl 2-7, Army (1988))
Average Surface Temp. Differential ( $v_s$ ) = $nF/t$ :	2.3
Initial Temp. Differential ( $v_o$ ) = MAT-32:	18
Thermal Ratio ( $\alpha$ ) = $v_s/v_o$ :	0.129
Assumed Dry Unit Weight:	90 pcf

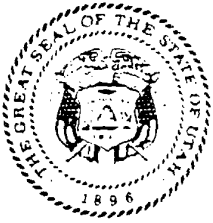
Moisture Content (w, %) <sup>1</sup>	Thermal Conductivity (K) <sup>2</sup>	Vol. Latent Heat of Fusion (L) <sup>3</sup>	Vol. Heat Capacity (C) <sup>4</sup>	Fusion Parameter ( $\mu$ ) <sup>5</sup>	$\lambda$ Coeff. <sup>6</sup>	Frost Penetration Depth (in) <sup>7</sup>
10	0.46	1296	22	0.039	0.98	19.0
12	0.50	1555	23.3	0.035	0.98	18.1
14	0.54	1814	24.7	0.032	0.98	17.4
16	0.58	2074	26	0.029	0.98	16.9
18	0.62	2333	27.5	0.027	0.98	16.4
20	0.64	2592	28.7	0.026	0.98	15.9

- NOTES:
- <sup>1</sup> Assumed range of potential values
  - <sup>2</sup> From Figure 2-2 for sands and gravels in Army (1988)
  - <sup>3</sup>  $L = 144\gamma_d(w/100)$
  - <sup>4</sup> From Figure 2-7 in Army (1988)
  - <sup>5</sup>  $\mu = v_s(C/L)$
  - <sup>6</sup> Using  $\alpha$  and  $\mu$  and Figure 3-1 in Army (1988)
  - <sup>7</sup>  $x = \lambda \cdot \text{sqrt}((48KnF)/L)$
-

**APPENDIX L**  
**Financial Assurance Documentation**

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Application for Renewal  
San Juan County Landfill



## San Juan County Commission

Ty Lewis - Chairman  
Mark Maryboy - Commissioner  
Bill Redd - Commissioner  
Rick M. Bailey - Administrator

September 4, 2002

Dennis R. Downs, Director  
Utah Division of Solid and Hazardous Waste  
Post Office Box 144880  
Salt Lake City, Utah 84114-4880

RE: June 28, 2002 Landfill Inspection and Escrow Agreement

Dear Mr. Downs:

Please find enclosed for your review and signature a new escrow agreement for PTIF Account #1630. If this new agreement is satisfactory, please sign and forward onto the State Treasurer. The County would appreciate receiving a copy of the signed agreement for our files when the agreement has been finalized.

Thank you for your attention to this matter. Please feel free to contact me if you have any questions or concerns.

Very truly,

Rick M. Bailey, Administrator  
San Juan County Commission

CC: Paul D. Barr  
Norman L. Johnson  
Dayne Shumway  
Independent Auditors

Attachment:

## ESCROW AGREEMENT

### I. SUMMARY

#### Parties to the Agreement:

1. Depositor: San Juan County Landfill Post Closure (the "Entity")  
Address: Post Office Box 817  
Monticello, Utah 84535-0817  
  
Contact: Paul Barr Tel. No. (435) 587-3237  
 Tel. No.
2. State Agency: Utah Division of Solid & Hazardous Waste (the "State")  
Address: P.O. Box 144880  
Salt Lake City, Utah 84114-4880  
  
Contact: Ralph Bohn, Section Mgr. Tel. No. 801-538-6170  
 Tel. No.   
 Tel. No.
3. Escrow Agent: Utah State Treasurer (the "Treasurer")  
215 State Capitol  
Salt Lake City, Utah 84114  
  
Contact: Robert C. Kirk, Financial Manager  
Stephanie Baldes, Accountant  
  
Telephone: (801)538-1042 Telefax: (801)538-1465 Toll free: 800-395-7665

#### B. Deposit Amount(s):

1. Principal amount \$ 31,755.15 (the "Proceeds") (Original Deposit)
2. Additional amount(s), if any:  
\$ 500,000.00 From: Deposited 12/26/01  
\$ From:   
\$ From:

#### C. Authorizing Resolution:

n/a  
 (the "Instrument")

#### D. Project Description:

Landfill Post Closure  
 (the "Project")

This Summary is an integral part of the Escrow Agreement

## II. AGREEMENT

- A. The undersigned hereby deliver to the Treasurer, the Proceeds and Additional amount(s) to be held and disposed of by the Treasurer in accordance with the duties, instructions, and upon the terms and conditions hereinafter set forth in this Escrow Agreement to which the undersigned hereby agree:
  1. For purposes of this Escrow Agreement and this Escrow Agreement only:
    - (a) The Treasurer shall not incur any liability in acting upon any written authorization and request delivered hereunder and believed by the Treasurer to be genuine and to be signed by the proper parties.
    - (b) The Treasurer may consult with legal counsel in the event of any dispute or question as to the construction of the Treasurer's duties hereunder and shall not be held to any liability for acting in accordance with advice so received.
    - (c) The Treasurer shall have a first lien on the moneys held by it hereunder for its compensation and for any costs, liability or expense or counsel fees it may incur.
  2. In the event of any disagreement between the undersigned or any of them, and/or any other person, resulting in adverse claims and demands being made in connection with or for any moneys involved herein or affected hereby, the Treasurer shall be entitled at its option to refuse to comply with any such claim or demand, so long as such disagreement shall continue, and in so refusing the Treasurer may refrain from making any delivery or other disposition of any moneys involved herein or affected hereby and in so doing the Treasurer shall not be or become liable to the undersigned or any of them or to any person or party for its failure or refusal to comply with such conflicting or adverse demands, and the Treasurer shall be entitled to continue so to refrain and refuse so to act until:
    - (a) The rights of the adverse claimants have been finally adjudicated in a court assuming and having jurisdiction of the parties and the moneys involved herein or affected hereby; and/or
    - (b) All differences shall have been adjusted by agreement and the Treasurer shall have been notified thereof in writing signed by all of the persons interested.
  3. The fees for the usual services of the Treasurer under the terms of this Escrow agreement are set forth in the schedule attached hereto as **Exhibit A**. It is agreed that additional compensation shall be paid to the Treasurer for any additional or extraordinary service it may be requested to render hereunder, and the Treasurer shall be reimbursed for any out-of-pocket expenses (including, without limitation, fees of counsel) reasonably incurred in connection with additional or extraordinary services.
  4. The Entity and the State hereby agree that the deposit of the Proceeds shall constitute compliance with applicable deposit and investment provisions of the Instrument.
  5. The duties of the Treasurer under the terms of this Escrow Agreement are as follows:
    - (a) The Treasurer shall receive into a separate fund (the "Escrow Account") Proceeds and any additional amounts to be used in connection with the Project.
    - (b) The Treasurer shall reimburse Entity in amounts authorized in writing by the Entity and the State.
    - (c) Each authorization must be signed by one official from both the Entity and the State, except as provided in (i) of this section, and shall be substantially the same as the form attached as Exhibit B. On behalf of the Entity, the written authorization and request shall be signed by any one of the officials of the Entity identified in Section I.A. 1. above. On behalf of the State, the written authorization and request shall be signed by any one of the officials of the State identified in Section I.A.2. above. The Treasurer assumes no responsibility for expenditure



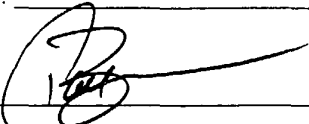
of moneys paid out of the Escrow Account pursuant to a written authorization and request properly signed and delivered the Treasurer as provided herein.

- (i) If the Entity fails to provide closure, post-closure, or corrective action of the solid waste management facility as required by the *Utah Solid Waste Permitting and Management Rules* and the Entity's solid waste disposal permit, the Executive Secretary will issue an order to close under the authority of Section 19-6-107(7) of the Utah Solid and Hazardous Waste Act. Upon completion of the Administrative process, including the Entity's right to contest and appeal the administrative action, the State may independently request, in writing, reimbursement to a State-approved and authorized third party for the costs related to the third party's activities for closure, post-closure or corrective actions at the facility.
- (d) If a written authorization and request indicates that an amount (the "Retained Amount") payable to a Provider is to be held for retainage pending completion of the Project or the lapse of time, the Treasurer shall segregate such amount and shall invest the Retained Amount in an interest-bearing account (the "Separate Account"), the interest on which shall accrue for the benefit of the Provider. The Retained Amount and all accrued interest thereon shall be disbursed by the Treasurer in the same manner as provided in paragraph 5(b) hereof. All fees charged or incurred by the Treasurer relating to the establishment, investment and disbursement of the Separate Account shall be borne solely by the Provider and may be withheld by the Treasurer from the Separate Account prior to the disbursement thereof; provided, however, that if such fees are borne by the Separate Account, and if the interest earned on the Separate Account is less than the amount of such fees, then the fees withheld from such Separate Account shall not exceed the interest earned and the balance of such fees shall be paid by the Entity.
- (e) The funds deposited by the parties hereto in the Escrow Fund and in any Separate Account shall be invested by the Treasurer in the Utah Public Treasurers' Investment Fund established by Section 51-7-5 of the Utah Code. All interest earned on moneys held in the Escrow Account shall be retained therein and disbursed as provided herein.
- (f) The Treasurer shall report at least monthly concerning the receipts, disbursements and status of the Escrow Account. The reports shall be mailed to the Entity and to the State at their respective addresses as shown in Section I.A. above. Notification of changes of address, if any, shall be in writing and mailed to the parties at their respective addresses as shown in Section I.A. above.
- (g) This Escrow Agreement will be terminated after payment of the fees and out-of-pocket expenses of the Treasurer, and upon liquidation of the Escrow Account as provided herein. This Escrow Account, upon the earlier to occur of:
  - (i) receipt by the Treasurer of a written authorization and request, signed as provided in paragraph 5(c) hereof, stating that the acquisition, construction, improvement and extension of the Project is complete, that all obligations and costs in connection with the Project which are payable out of the Escrow Account have been paid and discharged, and that the Treasurer is authorized and directed to transfer all moneys in the Escrow Fund to the Entity or such other disposition as may be agreed by the State and the Entity; or
  - (ii) receipt by the Treasurer of a written certificate of the State, signed by the appropriate representatives thereof as identified in paragraph 5(c) hereof, stating that at least months have expired from the date of this Agreement and that all remaining moneys in the Escrow Account are to be transferred to the State as a prepayment on the Bond purchased by the State or such other disposition as may be specified by the State.

6. This Agreement may be modified or amended only by a written Amendment attached to this Agreement and signed by the parties to this Agreement.

DATED this 04 day of Sept, 2002.

Entity: San Juan County

By: 

Title: County Treasurer

Attest and Countersign:

By: 

Title: County Administrator

STATE: Utah Division of Solid and Hazardous Waste

By: \_\_\_\_\_

Title: Executive Secretary  
Utah Solid & Hazardous Waste Control Board

Accepted:

Utah State Treasurer

By: \_\_\_\_\_

Title: \_\_\_\_\_

## EXHIBIT A

### Fees due to State Treasurer as Escrow Agent

---

Maximum annual fee is 10 basis points (one-tenth of one percent (.001)) applied to the average daily balance in each account. The fee is assessed monthly based on the actual number of days in the month divided by 360 days.

Minimum annual fee is zero.

The Treasurer intends to deduct the administrative fee from gross earnings of each account before crediting earnings to the account(s). The amount of such fees is not reflected on monthly statements to the Entity, and is payable only from gross earnings on the account(s).

Entity shall not be liable to the Treasurer for any other costs or expenses for usual services. Usual services include:

1. Acceptance of funds delivered for deposit.
2. Deposit of funds and issuance of Treasurer's Receipt.
3. Investment of all funds delivered to Treasurer.

Credit net interest earnings to designated account(s) on a monthly basis.

5. Reimburse entity for project costs pursuant to receipt of a written authorization and request properly signed and delivered to the Treasurer.
6. Prepare and deliver to Entity and State a monthly accounting showing all deposits, withdrawals, interest credits and rate, ending balance and average balance for each account.

Entity will be liable to the Treasurer for out-of-pocket expenses resulting from any additional or extraordinary service Treasurer is requested to render and reasonably incurs in connection with additional or extraordinary services.

EXHIBIT B -1

WRITTEN AUTHORIZATION AND REQUEST FOR REIMBURSEMENT  
FROM ESCROW FUND

TO: The Utah State Treasurer, as Escrow Agent (the "Treasurer").

DATE: \_\_\_\_\_

WRITTEN REQUEST NO.: \_\_\_\_\_

I, the undersigned authorized officer of \_\_\_\_\_, (the "Entity"),  
do hereby certify and request to the Treasurer as follows:

7. Pursuant to the provisions of the Escrow Agreement by and between the Entity, the State and the Treasurer dated \_\_\_\_\_, (the "Escrow Agreement"), the undersigned hereby authorizes and requests a reimbursement from the Escrow Account to pay the amounts shown on the attached Payment Schedule.
8. Each payment proposed to be made as set forth on the Payment Schedule has been incurred and is a proper charge against the Escrow Account.
9. To the extent that the payment of any item set forth on the Payment Schedule is for other than work, materials, equipment or supplies, in connection with this authorization and request, the undersigned certifies that each payment proposed to be made on the Payment Schedules is a proper charge against the Escrow Account, is a reasonable amount and has not been heretofore included in a prior Written Authorization and Request for Reimbursement for the Escrow Account.
10. This Written Authorization and Request, including the Payment Schedule attached hereto, shall be conclusive evidence of the facts and statements set forth herein.
11. A copy of this Written Authorization and Request is being kept on file in the official records of the Entity.

The terms used herein which are defined in the Escrow Agreement shall have the respective meanings therein assigned to them.

\_\_\_\_\_  
By: \_\_\_\_\_

Title: \_\_\_\_\_

EXHIBIT B-2

I/we, the undersigned authorized officer(s) of the State, do hereby certify and request to the Treasurer follows:

1. I/we have reviewed the foregoing statements of the authorized officer of the Entity attached hereto, and on behalf of the State approve the request for payment from the Escrow Fund made therein; provided that the State has not independently verified the statements of such authorized officer of the Entity attached hereto and makes no representations or certifications with respect thereto.
2. A copy of this Written Authorization and Request is being kept on file in the official records of the State.

The terms used herein shall have the same meanings assigned to them in the attached statements of the authorized officer of the Entity.

Dated the date appearing at the top of the attached statements of the authorized officer of the Entity.

STATE:

By: \_\_\_\_\_

Title: \_\_\_\_\_

### REIMBURSEMENT SCHEDULE

Contact Person at time of Wire Transfer \_\_\_\_\_  
(name) (phone #)

UTAH PUBLIC TREASURERS' INVESTMENT FUND  
New Account Application and Change Form

DATE 9/4/02

A. Title of Account San Juan County Landfill Post Closure

PTIF Account Number(s) Existing Account #1630

**ACTION:**

<input type="checkbox"/> Create New PTIF Account (Sec. A,C,D,E,F)	<input type="checkbox"/> Change Bank/Account (Sec. A,B,E,F).	<input type="checkbox"/> Add Bank/Account (Sec. A,B,E,F)
<input type="checkbox"/> Change Address (Sec. A,B,D,F)	<input checked="" type="checkbox"/> Change Authorized Individuals (Sec. A,B, C,F)	<input type="checkbox"/> Change Internet Access (Sec. A,B,C,F)

**C. Individuals Authorized to Make Deposits/Withdrawals:**

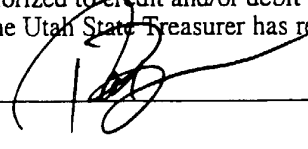
	<u>NAME</u>	<u>TITLE</u>	<u>PHONE</u>	<u>INTERNET ACCESS (Y/N)</u>
1.	Paul Barr	County Treasurer	435 587 3237	YES
2.	Norman Johnson	County Clerk Auditor	435-587-3223	YES
3.	Dennis Downs	Division Director	801-538-6170	YES
4.				

D. PTIF Statement Mailing Address: San Juan County Treasurer Utah Division of Solid  
Attn: Paul Barr County Treasurer and Hazardous Waste  
Post Office Box 817 Dennis Downs  
Monticello, Utah 84535 P.O. Box 144880  
Salt Lake City, UT  
84114-4880

**E. Bank (Depository) Information:**

<u>New/Additional Bank</u>	<u>Delete Bank</u>
a. Name of Bank _____	Name of Bank _____
b. Account Number _____	Account Number _____
<input type="checkbox"/> Checking <input type="checkbox"/> Savings <input type="checkbox"/> Other _____	

**F. Authorization:** In accordance with applicable statutes and procedures established by the Utah State Treasurer, we the undersigned hereby authorize the Utah State Treasurer to make the above changes and/or initiate wire and/or automated clearing house (ACH) credit entries and/or debit entries to our bank indicated above. The depository named above is authorized to credit and/or debit the same to such account. This authorization is to remain in full force and effect until the Utah State Treasurer has received written notification from us of its termination.

Signed <u></u>	9/4/02 <sup>*</sup>	Signed _____
	(Date)	(Date)
Name <u>Paul Barr</u>		Name _____
Title <u>San Juan County Treasurer</u>		Title _____

**TWO SIGNATURES REQUIRED**

Please attach a deposit slip and return this form to:

Utah State Treasurer's Office  
215 State Capitol  
Salt Lake City, Utah 84114

\* Must be a registered user, see our website at [www.treasurer.state.ut.us](http://www.treasurer.state.ut.us)

## ESCROW AGREEMENT

### I. SUMMARY

#### A. Parties to the Agreement:

1. Depositor: San Juan County Landfill Post Closure (the "Entity")  
Address: Post Office Box 817  
Monticello, Utah 84535-0817

Contact: Paul Barr Tel. No. (435) 587-3237  
Tel. No. \_\_\_\_\_

2. State Agency: Utah Division of Solid & Hazardous Waste (the "State")  
Address: P.O. Box 144880  
Salt Lake City, Utah 84114-4880

Contact: Ralph Bohn, Section Mgr. Tel. No. 801-538-6170  
Tel. No. \_\_\_\_\_  
Tel. No. \_\_\_\_\_

3. Escrow Agent: Utah State Treasurer (the "Treasurer")  
215 State Capitol  
Salt Lake City, Utah 84114

Contact: Robert C. Kirk, Financial Manager  
Stephanie Baldes, Accountant

Telephone: (801)538-1042 Telefax: (801)538-1465 Toll free: 800-395-7665

#### B. Deposit Amount(s):

1. Principal amount \$ 31,755.15 (the "Proceeds") (Original Deposit)

2. Additional amount(s), if any:

\$ 500,000.00 From: Deposited 12/26/01  
\$ \_\_\_\_\_ From: \_\_\_\_\_  
\$ \_\_\_\_\_ From: \_\_\_\_\_

#### C. Authorizing Resolution:

n/a

\_\_\_\_\_  
(the "Instrument")

#### D. Project Description:

Landfill Post Closure

\_\_\_\_\_  
(the "Project")

This Summary is an integral part of the Escrow Agreement



## II. AGREEMENT

A. The undersigned hereby deliver to the Treasurer, the Proceeds and Additional amount(s) to be held and disposed of by the Treasurer in accordance with the duties, instructions, and upon the terms and conditions hereinafter set forth in this Escrow Agreement to which the undersigned hereby agree:

1. For purposes of this Escrow Agreement and this Escrow Agreement only:
  - (a) The Treasurer shall not incur any liability in acting upon any written authorization and request delivered hereunder and believed by the Treasurer to be genuine and to be signed by the proper parties.
  - (b) The Treasurer may consult with legal counsel in the event of any dispute or question as to the construction of the Treasurer's duties hereunder and shall not be held to any liability for acting in accordance with advice so received.
  - (c) The Treasurer shall have a first lien on the moneys held by it hereunder for its compensation and for any costs, liability or expense or counsel fees it may incur.
2. In the event of any disagreement between the undersigned or any of them, and/or any other person, resulting in adverse claims and demands being made in connection with or for any moneys involved herein or affected hereby, the Treasurer shall be entitled at its option to refuse to comply with any such claim or demand, so long as such disagreement shall continue, and in so refusing the Treasurer may refrain from making any delivery or other disposition of any moneys involved herein or affected hereby and in so doing the Treasurer shall not be or become liable to the undersigned or any of them or to any person or party for its failure or refusal to comply with such conflicting or adverse demands, and the Treasurer shall be entitled to continue so to refrain and refuse so to act until:
  - (a) The rights of the adverse claimants have been finally adjudicated in a court assuming and having jurisdiction of the parties and the moneys involved herein or affected hereby; and/or
  - (b) All differences shall have been adjusted by agreement and the Treasurer shall have been notified thereof in writing signed by all of the persons interested.
3. The fees for the usual services of the Treasurer under the terms of this Escrow agreement are set forth in the schedule attached hereto as **Exhibit A**. It is agreed that additional compensation shall be paid to the Treasurer for any additional or extraordinary service it may be requested to render hereunder, and the Treasurer shall be reimbursed for any out-of-pocket expenses (including, without limitation, fees of counsel) reasonably incurred in connection with additional or extraordinary services.
4. The Entity and the State hereby agree that the deposit of the Proceeds shall constitute compliance with applicable deposit and investment provisions of the Instrument.
5. The duties of the Treasurer under the terms of this Escrow Agreement are as follows:
  - (a) The Treasurer shall receive into a separate fund (the "Escrow Account") Proceeds and any additional amounts to be used in connection with the Project.
  - (b) The Treasurer shall reimburse Entity in amounts authorized in writing by the Entity and the State.
  - (c) Each authorization must be signed by one official from both the Entity and the State, except as provided in (i) of this section, and shall be substantially the same as the form attached as Exhibit B. On behalf of the Entity, the written authorization and request shall be signed by any one of the officials of the Entity identified in Section I.A. 1. above. On behalf of the State, the written authorization and request shall be signed by any one of the officials of the State identified in Section I.A.2. above. The Treasurer assumes no responsibility for expenditure

of moneys paid out of the Escrow Account pursuant to a written authorization and request properly signed and delivered the Treasurer as provided herein.

- (i) If the Entity fails to provide closure, post-closure, or corrective action of the solid waste management facility as required by the *Utah Solid Waste Permitting and Management Rules* and the Entity's solid waste disposal permit, the Executive Secretary will issue an order to close under the authority of Section 19-6-107(7) of the Utah Solid and Hazardous Waste Act. Upon completion of the Administrative process, including the Entity's right to contest and appeal the administrative action, the State may independently request, in writing, reimbursement to a State-approved and authorized third party for the costs related to the third party's activities for closure, post-closure or corrective actions at the facility.
- (d) If a written authorization and request indicates that an amount (the "Retained Amount") payable to a Provider is to be held for retainage pending completion of the Project or the lapse of time, the Treasurer shall segregate such amount and shall invest the Retained Amount in an interest-bearing account (the "Separate Account"), the interest on which shall accrue for the benefit of the Provider. The Retained Amount and all accrued interest thereon shall be disbursed by the Treasurer in the same manner as provided in paragraph 5(b) hereof. All fees charged or incurred by the Treasurer relating to the establishment, investment and disbursement of the Separate Account shall be borne solely by the Provider and may be withheld by the Treasurer from the Separate Account prior to the disbursement thereof; provided, however, that if such fees are borne by the Separate Account, and if the interest earned on the Separate Account is less than the amount of such fees, then the fees withheld from such Separate Account shall not exceed the interest earned and the balance of such fees shall be paid by the Entity.
- (e) The funds deposited by the parties hereto in the Escrow Fund and in any Separate Account shall be invested by the Treasurer in the Utah Public Treasurers' Investment Fund established by Section 51-7-5 of the Utah Code. All interest earned on moneys held in the Escrow Account shall be retained therein and disbursed as provided herein.
- (f) The Treasurer shall report at least monthly concerning the receipts, disbursements and status of the Escrow Account. The reports shall be mailed to the Entity and to the State at their respective addresses as shown in Section I.A. above. Notification of changes of address, if any, shall be in writing and mailed to the parties at their respective addresses as shown in Section I.A. above.
- (g) This Escrow Agreement will be terminated after payment of the fees and out-of-pocket expenses of the Treasurer, and upon liquidation of the Escrow Account as provided herein. This Escrow Account, upon the earlier to occur of:
  - (i) receipt by the Treasurer of a written authorization and request, signed as provided in paragraph 5(c) hereof, stating that the acquisition, construction, improvement and extension of the Project is complete, that all obligations and costs in connection with the Project which are payable out of the Escrow Account have been paid and discharged, and that the Treasurer is authorized and directed to transfer all moneys in the Escrow Fund to the Entity or such other disposition as may be agreed by the State and the Entity; or
  - (ii) receipt by the Treasurer of a written certificate of the State, signed by the appropriate representatives thereof as identified in paragraph 5(c) hereof, stating that at least months have expired from the date of this Agreement and that all remaining moneys in the Escrow Account are to be transferred to the State as a prepayment on the Bond purchased by the State or such other disposition as may be specified by the State.

6. This Agreement may be modified or amended only by a written Amendment attached to this Agreement and signed by the parties to this Agreement.

DATED this 04 day of Sept, 2002.

Entity: San Juan County

By: \_\_\_\_\_

Title: County Treasurer

Attest and Counter sign:

By: \_\_\_\_\_

*Rick M Bailey*

Title: County Administrator

STATE: Utah Division of Solid and Hazardous Waste

By: \_\_\_\_\_

Title: Executive Secretary  
Utah Solid & Hazardous Waste Control Board

Accepted:

Utah State Treasurer

By: \_\_\_\_\_

Title: \_\_\_\_\_

## EXHIBIT A

### Fees due to State Treasurer as Escrow Agent

---

Maximum annual fee is 10 basis points (one-tenth of one percent (.001)) applied to the average daily balance in each account. The fee is assessed monthly based on the actual number of days in the month divided by 360 days.

Minimum annual fee is zero.

The Treasurer intends to deduct the administrative fee from gross earnings of each account before crediting earnings to the account(s). The amount of such fees is not reflected on monthly statements to the Entity, and is payable only from gross earnings on the account(s).

Entity shall not be liable to the Treasurer for any other costs or expenses for usual services. Usual services include:

1. Acceptance of funds delivered for deposit.
2. Deposit of funds and issuance of Treasurer's Receipt.
3. Investment of all funds delivered to Treasurer.
4. Credit net interest earnings to designated account(s) on a monthly basis.
5. Reimburse entity for project costs pursuant to receipt of a written authorization and request properly signed and delivered to the Treasurer.
6. Prepare and deliver to Entity and State a monthly accounting showing all deposits, withdrawals, interest credits and rate, ending balance and average balance for each account.

Entity will be liable to the Treasurer for out-of-pocket expenses resulting from any additional or extraordinary service Treasurer is requested to render and reasonably incurs in connection with additional or extraordinary services.

EXHIBIT B -1

WRITTEN AUTHORIZATION AND REQUEST FOR REIMBURSEMENT  
FROM ESCROW FUND

TO: The Utah State Treasurer, as Escrow Agent (the "Treasurer").

DATE: \_\_\_\_\_

WRITTEN REQUEST NO.: \_\_\_\_\_

I, the undersigned authorized officer of \_\_\_\_\_, (the "Entity"),  
do hereby certify and request to the Treasurer as follows:

7. Pursuant to the provisions of the Escrow Agreement by and between the Entity, the State and the Treasurer dated \_\_\_\_\_, (the "Escrow Agreement"), the undersigned hereby authorizes and requests a reimbursement from the Escrow Account to pay the amounts shown on the attached Payment Schedule.
8. Each payment proposed to be made as set forth on the Payment Schedule has been incurred and is a proper charge against the Escrow Account.
9. To the extent that the payment of any item set forth on the Payment Schedule is for other than work, materials, equipment or supplies, in connection with this authorization and request, the undersigned certifies that each payment proposed to be made on the Payment Schedules is a proper charge against the Escrow Account, is a reasonable amount and has not been heretofore included in a prior Written Authorization and Request for Reimbursement for the Escrow Account.
10. This Written Authorization and Request, including the Payment Schedule attached hereto, shall be conclusive evidence of the facts and statements set forth herein.
11. A copy of this Written Authorization and Request is being kept on file in the official records of the Entity.

The terms used herein which are defined in the Escrow Agreement shall have the respective meanings therein assigned to them.

\_\_\_\_\_  
By: \_\_\_\_\_

Title: \_\_\_\_\_

EXHIBIT B-2

I/we, the undersigned authorized officer(s) of the State, do hereby certify and request to the Treasurer as follows:

1. I/we have reviewed the foregoing statements of the authorized officer of the Entity attached hereto, and on behalf of the State approve the request for payment from the Escrow Fund made therein; provided that the State has not independently verified the statements of such authorized officer of the Entity attached hereto and makes no representations or certifications with respect thereto.
2. A copy of this Written Authorization and Request is being kept on file in the official records of the State.

The terms used herein shall have the same meanings assigned to them in the attached statements of the authorized officer of the Entity.

Dated the date appearing at the top of the attached statements of the authorized officer of the Entity.

STATE:

By: \_\_\_\_\_

Title: \_\_\_\_\_

### REIMBURSEMENT SCHEDULE

Contact Person at time of Wire Transfer \_\_\_\_\_  
(name) (phone #)

# UTAH PUBLIC TREASURERS' INVESTMENT FUND

Account Application and Change Form

DATE 9/4/02

A. Title of Account San Juan County Landfill Post Closure

PTIF Account Number(s) Existing Account #1630

## ACTION:

<input type="checkbox"/> Create New PTIF Account (Sec. A,C,D,E,F)	<input type="checkbox"/> Change Bank/Account (Sec. A,B,E,F).	<input type="checkbox"/> Add Bank/Account (Sec. A,B,E,F)
<input type="checkbox"/> Change Address (Sec. A,B,D,F)	<input checked="" type="checkbox"/> Change Authorized Individuals (Sec. A,B, C,F)	<input type="checkbox"/> Change Internet Access (Sec. A,B,C,F)

## C. Individuals Authorized to Make Deposits/Withdrawals:

NAME	TITLE	PHONE	INTERNET ACCESS (Y/N)
1. Paul Barr	County Treasurer	435 587 3237	YES
2. Norman Johnson	County Clerk Auditor	435-587-3223	YES
3. Dennis Downs	Division Director	801-538-6170	YES
4.			

D. PTIF Statement Mailing Address: San Juan County Treasurer Utah Division of Solid

Attn: Paul Barr County Treasurer and Hazardous Waste

Post Office Box 817

Dennis Downs

Monticello, Utah 84535

P.O. Box 144880

Salt Lake City, UT

84114-4880

## E. Bank (Depository) Information:

### New/Additional Bank

### Delete Bank

a. Name of Bank \_\_\_\_\_

Name of Bank \_\_\_\_\_

b. Account Number \_\_\_\_\_

Account Number \_\_\_\_\_

☐ Checking ☐ Savings ☐ Other \_\_\_\_\_

F. **Authorization:** In accordance with applicable statutes and procedures established by the Utah State Treasurer, we the undersigned hereby authorize the Utah State Treasurer to make the above changes and/or initiate wire and/or automated clearing house (ACH) credit entries and/or debit entries to our bank indicated above. The depository named above is authorized to credit and/or debit the same to such account. This authorization is to remain in full force and effect until the Utah State Treasurer has received written notification from us of its termination.

Signed \_\_\_\_\_ 9/4/02

(Date)

Signed \_\_\_\_\_

(Date)

Name Paul Barr

Name \_\_\_\_\_

Title San Juan County Treasurer

Title \_\_\_\_\_

## TWO SIGNATURES REQUIRED

Please **attach a deposit slip** and return this form to:

Utah State Treasurer's Office

215 State Capitol

Salt Lake City, Utah 84114

Must be a registered user, see our website at [www.treasurer.state.ut.us](http://www.treasurer.state.ut.us)

Form UPTLF 1/2

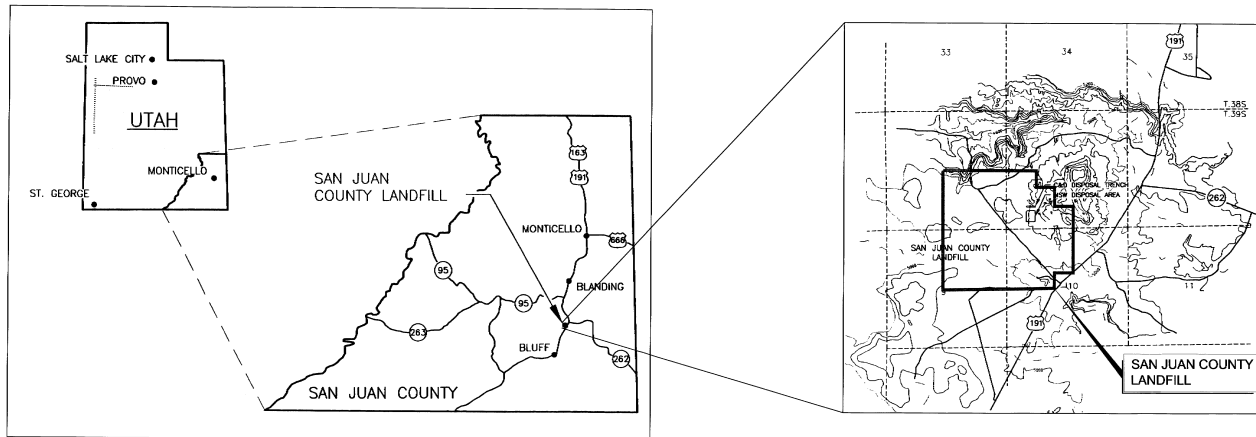


**APPENDIX M**  
**Design Drawing Set**  
Application for Renewal  
San Juan County Landfill

# ENGINEERING REPORT SAN JUAN COUNTY

## CLASS I MUNICIPAL SOLID WASTE DISPOSAL FACILITY

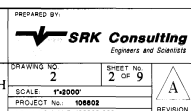
### SAN JUAN COUNTY LANDFILL SAN JUAN COUNTY, UTAH



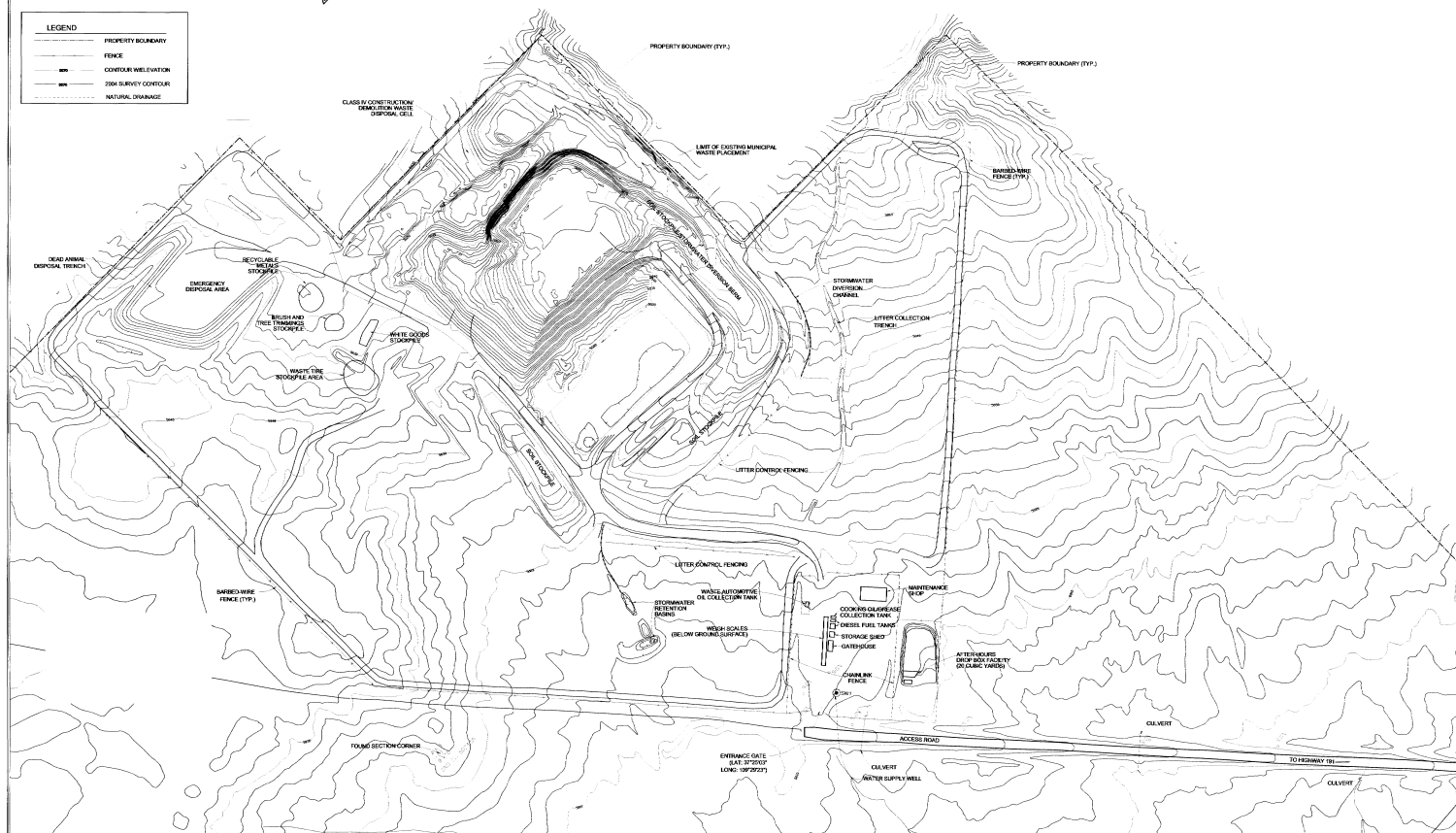
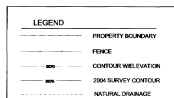
#### LIST OF DRAWINGS

SHEET	DWG. NO.	DRAWING TITLE
1 OF 9	106801-201	TITLE SHEET AND GENERAL PROJECT LOCATION MAP
2 OF 9	106801-202	U.S.G.S. 7.5 MINUTE QUADRANGLE MAP (1989)
3 OF 9	106801-203	EXISTING TOPOGRAPHY AND FACILITIES
4 OF 9	106801-204	1998 AND 2004 TOPOGRAPHY
5 OF 9	106801-205	FINAL GRADING PLAN
6 OF 9	106801-206	FILL SEQUENCING PLAN
7 OF 9	106801-207	CROSS-SECTIONS
8 OF 9	106801-208	DETAILS
9 OF 9	106801-209	HYDROLOGIC SUB-AREA LAYOUT

	NO. 106801-201 ISSUED FOR REGULATORY REVIEW		BY: RHH DATE: 4/05	PREPARED FOR: <b>SAN JUAN COUNTY LANDFILL</b>	PREPARED BY: <b>SRK Consulting</b> <i>Engineers and Scientists</i>
	DESIGNED: RHH DRAWN: RHH CHECKED: RHH APPROVED:		DATE: 4/05 DATE: 4/05	TITLE SHEET AND GENERAL PROJECT LOCATION	DRAWING NO.: 106801-201 SHEET NO.: 1 OF 9 SCALE: AS SHOWN REVISION:



△ 500 2. 5025.50  
--- SURVEY CONTROL POINT



No.		DESCRIPTION	BY	DATE
1	A	ISSUED FOR REGULATORY REVIEW	ROB	4/05
2	A		DESIGNED	ROB
			DRAWN	efg
			CHECKED	
			APPROVED	
3	A		APPROVED	

PREPARED FOR:

SAN JUAN COUNTY LANDFILL

### EXISTING TOPOGRAPHY and FACILITIES



DRAWING NO. 3	SHEET No. 3 of 9	
SCALE: 1"=100' PROJECT No.: 108502		





	NO. DATE ISSUED FOR REGULATORY REVIEW	DESCRIPTION	BY	DATE	PREPARED FOR	PROJECTED BY
			SRK	4/7/09	SAN JUAN COUNTY LANDFILL	
		DESIGNED	DSD	4/7/09	V.L.C.	ORDERING NO.
		CHECKED	WJG	4/7/09		SHEET NO.
		APPROVED				
<b>1998 AND 2004 TOPOGRAPHY</b>						
		SCALE: _____ PROJECT NO.: 06680			TOTAL SHEETS: 1000-000 REVISIONS	

San Juan County  
STANLEY CONTROL POINT

CLASS IV GAS DISPOSAL FACILITY

POSSIBLE FUTURE CLASS IV GAS DISPOSAL AREA

EMERGENCY  
DISPOSAL AREA

① DROP INLET W/VALVE (TYP)

② T-SECTION (TYP)

③ T-SECTION ACCESS ROAD (TYP)

④ V-PIKE (TYP)

WASTE ALTERNATIVE  
OR COLLECTION TANK

WASH SINKS  
(BELOW GROUND SURFACE)

COPYING OR STORAGE  
COLLECTION TANK

DIESEL FUEL TANKS

STORAGE TENDS

GENERATOR

CONCRETE  
FENCE

⑤ 2" DIA

⑥ DRAINAGE CHANNEL (TYP)

⑦ FLOW CONTROL (TYP) - 8" DIA

⑧ DRAINAGE SINK (TYP)

⑨

PROPOSED LIMIT OF WASTE PLACEMENT

PROPERTY BOUNDARY (TYP)

PERMITTER ACCESS ROAD (TYP)

⑩

PROPOSED FENCE RE-ALIGNMENT

⑪

AFTER-HOURS  
DROP-OFF FACILITY  
(20 CURB TIRAGE)

BARRIED-WIRE FENCE (TYP)

San Juan County  
San Juan County

SURVEYED SECTION CORNER

ENTRANCE GATE  
EAC: 372501  
LONG: 10729237

# LEGEND

- PROPERTY BOUNDARY
- FENCE
- CONTOUR W/ELEVATION
- PROPOSED DRAINAGE  
SINK OR CHANNEL
- ROAD AND/OR DRAINAGE SLOPE
- PROPOSED GAS MONITORING  
POINT
- GROUND WATER SUPPLY WELL
- REFUSE

- ① CROSS SECTION LOCATION  
W/STREET REFERENCE
- ② RETAIN CULVERT W/STREET  
SHEET REFERENCE

0 50 100  
FEET



REVISION	DESCRIPTION	BY	DATE
1	ISSUED FOR REGATORY REVIEW	JBH	4/7/00
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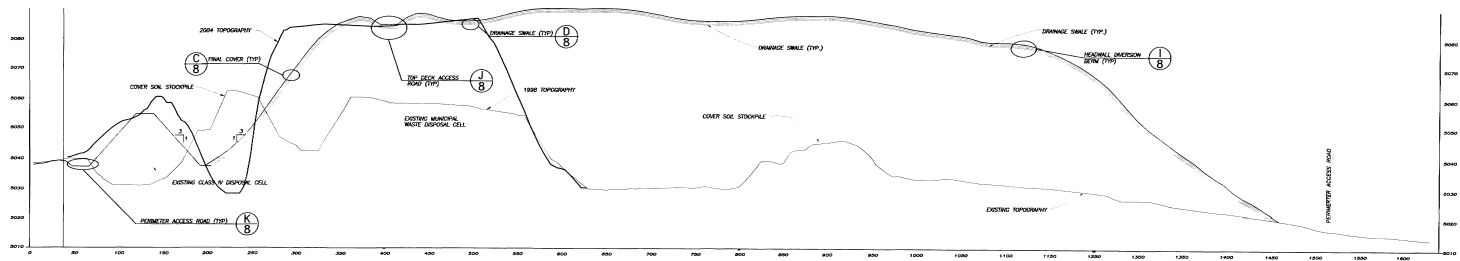
PREPARED FOR:  
**SAN JUAN COUNTY LANDFILL**

**FINAL GRADING PLAN**

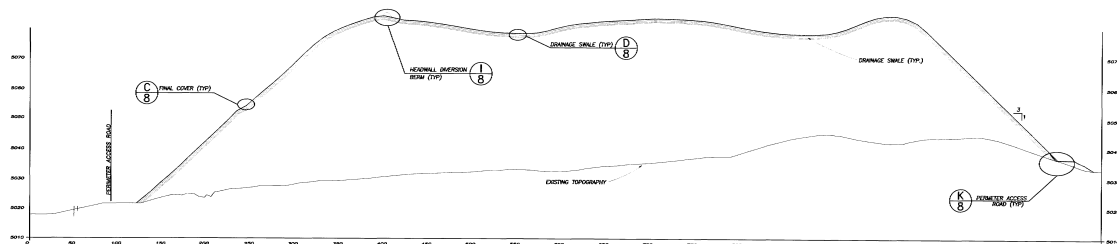
DESIGNED BY	JBH	DATE	4/7/00
CHECKED BY	JBH	DATE	4/7/00
APPROVED BY		DATE	
PROJECT NO.	100000		
DRAWING NAME	100000-000		
DATE	4/7/00		
SHEET NO.	5 OF 9		
SCALE	1" = 40'		
PROJECT NO.	100000		
DRAWING NAME	100000-000		

PREPARED BY:  
**SRK Consulting**  
CITY OF ALBUQUERQUE

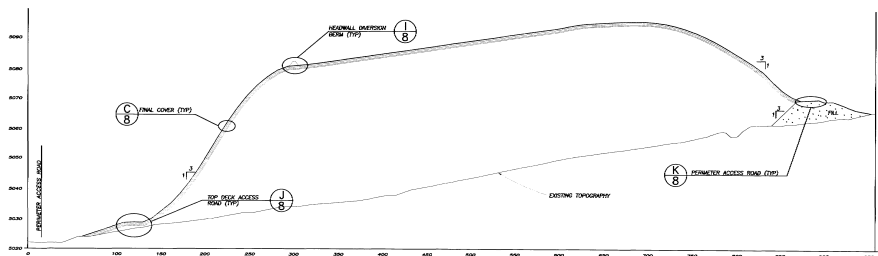




LANDFILL CROSS SECTION  
HORIZ 1"=50' VERT 1"=15'



LANDFILL CROSS SECTION  
HORIZ 1"=50' VERT 1"=15'



LANDFILL CROSS SECTION  
HORIZ 1"=50' VERT 1"=15'



NO.	DESCRIPTION	BY	DATE	PREPARED FOR
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SAN JUAN COUNTY LANDFILL

CROSS-SECTIONS

	
DRAWING NO. 7 SCALE: AS SHOWN PROJECT NO. 16882 DRAWING NAME: CROSS-SECTIONS	SHEET 17 OF 19 





